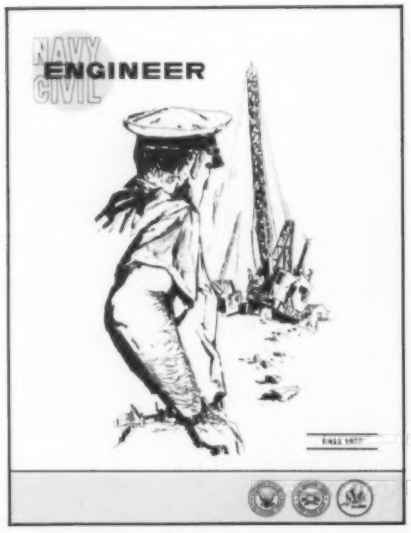
NAVY CIVIL ENGINEER

FALL 1977



CONSTRUCTION is what it's all about for the Naval Facilities Engineering Command and the Navy's Civil Engineer Corps and Seabees. This issue presents a few of the different aspects of naval construction — below the sea (UCT-2 Installs Underwater Cables, p. 16); above, the sea (Advanced Ocean Construction Techniques, p. 44) and what happens on good ol' terra firma when constructors are careless (The Environment During Construction, p. 30).

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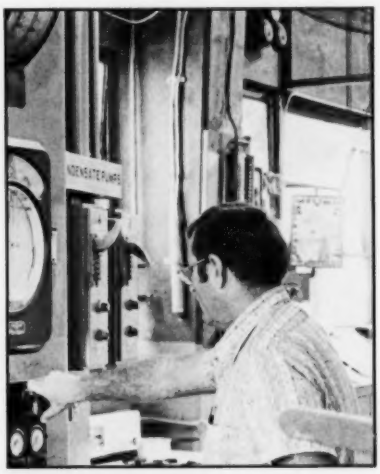
THIS COIN could be any taxpayer's coin. There's always another side of the coin and the article appearing on p. 4 appropriately addresses the two facets concerning in-house construction vs. contracted construction.

Readers Survey Results Appear On Page 23. For Those Readers Participating, Our Thanks. For Those Who Did *Not*, Your Comments Are Always Welcome!



ENERGY ECONOMICS — perhaps the nation's most serious concern is studied through NAVFAC surveys and measurements at selected naval installations. One recent activity is reported on p. 9.

TWO SIDES of the TAX COIN

By R. SIDNEY ARTHUR
Program Analyst
Resource Management Branch
NAVFAC HQ
• Alexandria, Va.

In July of 1776, the American colonies declared their independence from England and the Revolutionary War began. The new nation, critically needing warships, began construction of a 44-gun frigate at Boston.

In haste to complete the vessel green oak planking was used for the hull. This material proved so resilient that she was nicknamed *"Old Ironsides."*

In 1781 hostilities ended with the ship not completed. Partially built, the frigate remained at the Boston Naval Shipyard for sixteen years until its completion in 1797. When the first phase of confrontations between the United States and Great Britain ended, a local one began and *Old Ironsides* was the center of the dispute.

The question? Should the new government finish the job of building the ship or should this work be contracted to private enterprise? One hundred forty years before the Bureau of the Budget voiced opinions and one hundred eighty five years before OMB A-76 was published, the question of private contracting versus in-house operation had been raised.

When the commercial or industrial (C/I) program is discussed, a natural question is, "Just what does it encompass and when did it begin?" Well, there have been several "beginnings" to the program. The most recent originated under Presidents Eisenhower and Johnson. As to what it is, put simply, it is anything government does for itself that could be performed commercially.

The principal purpose of government is to govern and the principal purpose of business is to conduct business operations. Why has the government then entered into a number of commercial enterprises? For a number of reasons. Usually when the government has a need for a product or service that the commercial sector is either unwilling or unable to provide, or when it is required at a time when the private enterprise cannot provide it (such as in time of war), the government enters into its own production. These services can be divided into two categories, those which are intended to provide services for a part of the general public (referred to as "public service enterprises") and those which are intended to serve the government itself.

Examples of the "public service enterprises" would be the Tennessee Valley Authority or the U.S. Navy's production of electric power on Guam where the government generates electric power for sale to private parties. Examples of "government service" would extend over a range from ship building to janitorial services in federal buildings.

The major problem to be resolved: is government in competition with private interests and, if so, is it detrimental to the taxpayer? Obviously, the first part of the question must be answered in the affirmative since most products and services could be provided by the private sector. However, most of the commercial/industrial activities of the government today, including those of the Department of the Navy, benefit the taxpayer.

Many may not agree with this premise.

The government has engaged in various kinds of business operations from its earliest days including powder and ammunition plants, and the Philadelphia Army Quartermaster Clothing Factory even antedates the constitution. Until the 1960s, the government was still operating a ropewalk which began when the *USS Constitution (Old Ironsides)* was under construction.

Times of great national crisis and war give rise to a proliferation of government operated plants. The twentieth century, with two world wars, saw tremendous increases in these areas. The military departments, following World War II, had a larger payroll, a greater number of employees and a wider scope of production operations than any other government department. These activities included: arsenals, shipyards, sawmills, and aluminum, clothing, paint, and orthopedic device factories. The investment in these operations represented $15 billion at a time when the total assets of industrial corporations in the United States were over $800 billion.

Should the government operate commercial/industrial activities? This question is often raised and hotly debated. The Hoover Commission recommended that 30% of the government's business activities be eliminated. The U.S. Air Force, at some bases, is presently contracting all base service and public works activities. On the other hand, certain groups feel that a strong case can be made for expanding government business operations on the theory that the government can provide those services at a lower cost to the taxpayer than can the private sector. And there are several studies to support this position.

There are, consequently, groups within the government that are advocating more government operation in this area and there are groups that favor less government operation of commercial activities.

The main arguments that are presented in opposition to government operations are:

1. Private enterprise is deprived of business that it has a right to expect.

2. Tax money is being used to support competing activities so that a tax-paying private contracting

firm is, in essence, competing with themselves.

3. Federal, state, and local governments are deprived of taxes they would collect if the activity were privately owned and tax paying.

4. An activity which is excessive could represent a possible reduction in government expenditures.

5. The government's task is to govern and not to engage in competition with private enterprise.

Arguments that have been presented for continuing government enterprises are:

1. National security requires the government to maintain control over certain operations.

2. Many products that the government requires can be produced more economically and at much lower cost than if purchased from private industry.

3. The quality of privately produced goods may not meet the rigid government specifications.

4. Convenience to the government to produce its own products dependent on certain situations.

5. The government should produce those goods and services that are necessary for it to carry out its responsibilities to the public.

6. Termination of government operated activities may result in the unemployment of a large number of skilled employees with the adverse economic effects on local communities.

7. The necessity of maintaining research and development facilities.

These same arguments or variations of them have been presented from the presidential level to operating agency levels since the beginning of the Republic.

The De-Competition Program

The question of government operated business was injected in the Republican presidential campaign of Dwight Eisenhower when he specifically promised that "no federal project will be undertaken which private enterprise could undertake." However, he was to find that his real problems would arise not in preventing the creation of new Federal projects but closing down existing ones. His program was referred to as "de-competition."

In the mid-fifties the president requested a study of these activities. Executive policy was that the Federal Government would not start or carry out any commercial/industrial activity to provide a service or product for its own use if such product or service could be procured from private enterprise through ordinary business channels.

It should be noted that these pronouncements did not mention costs. This was interpreted by many agencies that they were obliged to utilize private sources regardless of the costs or how competent the contractor. Also, no mention was made of government production of goods and services for consumption by the public at large. Presumably such activities as the Tennessee Valley Authority were exempt.

This study completed in 1961 (based upon an inventory taken in 1956 adjusted to 1960), reflected that there were approximately 24,100 government maintained commercial/industrial activities. Of this number 19,100 were maintained by civilian agencies and some 5,000 by the Department of Defense. Of the 19,100 civilian activities, 17,100 were determined to present no significant competition for free enterprise. Eight thousand of these were for custodial and janitorial services and 3,900 installations were bins owned by the Commodity Credit Corporation. Of the 2,000 activities which were in competition and for which no compelling reasons could be found for continuing government operation, 1,600 were discontinued and 400 were curtailed. Of the 5,000 Department of Defense activities, 2,900 were evaluated of which 450 were discontinued, 2,450 were continued with 150 of these curtailed.

After the presidential "de-competition" program, the Department of Defense issued its directive which provided for the continuation of activities only if it could be demonstrated that private enterprise could not supply the service or product. Five criteria were established:

1. Inaccessibility of commercial facilities.

2. Inability of private enterprise to supply the needs of fluctuating military demands.

3. Provision of training facilities that might be needed in a combat zone.

4. Necessity of preserving classified information.

5. Other considerations involving the "public interest as certified by the Secretary of Defense."

House of Representatives Bill 5115 was then introduced to prohibit the Department of Defense from disposing of work traditionally performed by civilian employees of the department. Federal employee unions also joined the campaign to retain the civilian work force.

The Senate Select Committee on Small Business also expressed concern. Congress was split on the issue. The Hoover Commission, in May 1955, recommended that the Department of Defense terminate 1,000 of its business type activities and transfer their functions to private enterprise.

House of Representatives Bill 5115 was attached as a rider to the Defense Appropriation Bill as section 638. This section provided that: *"No part of the funds appropriated in this Act may be used for the disposal or transfer by contract or otherwise of work traditionally performed by civilian personnel in the Department of Defense unless it has been justified before the appropriate committee of Congress that the disposal is economically sound and that the related services can be performed by a contractor without danger to national services."*

However, the Executive Branch threatened to ignore the rider which implied use of the item veto and, as such, was protested by Congress. The Attorney General found the section defective because it gave to the committees of Congress power that Congress was unable to delegate. He found that this section was separable from the rest of the Act and he therefore concluded that the President could informally veto this section without "prejudice to the rest."

The Comptroller General of the General Accounting Office, an arm of the legislature, issued a statement that said it was the prerogative of Congress to determine how monies were to be spent and so stated that, ". . . where we ascertain that expenditures of funds are

(Continued on page 6)

(Continued from page 5)

made in contravention of the provision of Section 638 of the Department of Defense Act of 1956, we will take appropriate action to disallow credit for such expenditure . . ."

This action would have involved 1,755 individual commercial/industrial operations. The result was a flood of proposals to close small activities. In one fiscal year congress was asked to decide upon the propriety of closing 112 activities ranging from motor pools to cobbler shops. In ten of the cases work was on a part time basis and in nine of these the work involved the part time effort of one person. In one instance the work was so trifling that the Department could not even determine its scope. The section of the annual appropriation bill was finally dropped.

During the life of this section, authority was granted to close approximately 50 activities, most small and of little consequence.

Present Government Position

After a period of relative inactivity, the arguments again began. This time it was a Democratic executive, President Johnson, who advocated reliance upon private enterprise, except in special circumstances.

On March 3, 1966, the president wrote to the heads of departments and agencies and stressed maximum effectiveness in the day-to-day operation of the government and to reduce the cost of carrying out government programs. President Johnson's approach to the commercial/industrial program was less severe than Eisenhower's approach of a decade earlier when Eisenhower stressed the need to reduce government's competition with business. Johnson stressed the need for government economies. He conceded that at times it is desirable or even necessary for the government to produce certain products or services for its own use. Johnson specified that these decisions must be exercised under uniform guidelines and principles in order:

1. To conduct the affairs of government on an orderly basis.
2. To limit budgetary costs.
3. To maintain the government's policy of reliance upon private enterprise.

He further requested the Director of the Bureau of the Budget to issue detailed guidelines to determine when the government should provide products and services for its own use. Also, he requested each department and agency head to designate an assistant secretary to review new proposals for the agency, to review the experience of the agency and to suggest changes.

He ended this memorandum by stating that he did not "wish to impose rigid or burdensome reporting requirements on each agency with respect to the new guidelines."

The Bureau of the Budget issued Circular A-76, also on March 3, 1966, to implement the executive policy. The Bureau of the Budget differed from the president's position by stating that the guidelines were a furtherance of the government's general policy of relying on the private enterprise system to supply its needs. Rather than stressing economy of operation, as the presidential letter had done, the bureau slipped back to the policies of the days of "de-competition."

Specified was that no executive agency would initiate a "new start" or continue operation of an existing "government commercial/industrial activity" except as specified in the circular. A "new start" was defined as a newly established government commercial/industrial activity or a reactivation, expansion, modernization or replacement of such activity involving additional capital investment of $25,000 or more, or additional annual costs of production of $50,000 or more.

Five reasons or circumstances under which the government could provide a commercial or industrial product or service were included in the circular. These circumstances are:

1. Procurement of a product or service would disrupt or materially delay an agency program.
2. It is necessary for the government to conduct a commercial or industrial activity for the purpose of combat support or for indidivual or unit training of military personnel as to maintain or strengthen mobilization readiness.
3. A satisfactory commercial source is not available and cannot be developed in time to provide a product or service when it is needed.
4. The product or service is not available from another federal agency, that is, excess government facilities of one agency should be used by another rather than going to a private source.
5. Procurement of the product or service would result in a higher cost to the government.

The circular further detailed extensive directions for making cost comparisons to include all personnel costs, materials, maintenance and repair of facilities, damage, federal taxes lost, depreciation, interest and other indirect costs. For existing government facilities the circular provided for reviews and reports sufficient to justify continuance.

The Department of Defense issued Directive Number 4100.15 of July 19, 1966 to define DoD policy on this matter. This directive restated the main parts of Circular A-76 including the five reasons for maintaining government operated commercial/industrial activities. In addition to the direction provided by the Bureau of Budget (BoB) the Department of Defense specified three other policies:

1. Within the limitations of BoB policy, DoD components will be equipped and staffed to carry out effectively and economically those commercial or industrial activities which must be performed internally in order to maintain military readiness requirements.
2. This policy is not to be used as authority for methods of contract personnel procurement not authorized by law nor as a means of avoiding government personnel or salary limitations.
3. DoD components will continue to perform for themselves those basic functions of management necessary to retain essential control over the content of their programs.

The objective hopefully was to result in maximum practicable reduction in DoD commercial or industrial activities consistent with budget office policy and to provide economies in DoD procurement of products and services.

(Continued on page 34)

New CEL Test Of Concrete Spheres

• Port Hueneme, Calif.

Virtually watertight and suffering no deterioration, three concrete spheres, each weighing 1,820kg (4,000 pounds), have been recovered by the Navy after being placed in the ocean for more than five years.

The retrieval of the concrete models (outside diameters of 168cm [66 inches] with 10.2cm [four-inch] thick walls) is the latest phase of a long-range study of deep-ocean concrete structures by the Civil Engineering Laboratory (CEL), Naval Construction Battalion Center, Port Hueneme, Calif. Naval Facilities Engineering Command (NAVFAC) authorized the work under the sponsorship of the Navy's Deep Ocean Technology program.

When CEL deployed 18 spheres at water depths ranging from 609.6 to 1,524m (2,000 to 5,000 feet) in September, 1971, it marked the first time such a large scale test had been programmed for the deep ocean for a prolonged period of time. Several of the concrete balls may remain in the ocean for more than 10 years, according to Harvey H. Haynes, senior research structural engineer in charge of the project.

Haynes said the epoxy-coated spheres, emplaced at 860m and 1,018m (2,635 and 3,140 feet) were completely dry inside. The permeability rate into the uncoated sphere at 920m (2,800 feet) was less than .029L (1 ounce) per day, or slightly more than a total of 23.7L (nine gallons) of water. "This represents an extremely low rate of seepage for a concrete wall only 10.2cm thick and exposed to such high pressures for five years and four months," Haynes explained. "We had expected some water within the coated spheres and were quite surprised to find none."

The prime purpose for the recovery was to measure water quantity but other data revealed no evidence of deterioration of the concrete properties. Haynes said the strength of the concrete actually improved to a degree. Concrete normally gets stronger upon continuous exposure to water. However the strength did not improve as much as identical concrete material stored in a moist environment (21°C) (70°F) on land. Haynes said the reason was probably that the recovered spheres had been exposed for more than five years in water temperatures of 4°C (39°F).

Surface inspection of the spheres revealed a small amount of grass-like animal growth on the coated spheres as well as a single small anemone and a grouping of small scallops. The uncoated sphere had white tubeworms on the exterior but less growth than was found on the steel chain links or coated concrete surfaces.

The spheres were returned to CEL for controlled testing in the laboratory's 183cm (72 inch) (inside diameter) pressure vessel. Before purposeful failure, all three had reached a simulated depth more than twice the ocean level at which they had been emplaced.

Samples of the concrete were sent to the University of California at Berkeley for additional analysis by X-ray defraction techniques to determine if any chemical composition changes took place.

Phillip C. Zubiate, CEL senior engineering technician in charge of retrieval, said a reel of braided nylon 1.27cm (½ inch) rope was attached to the front end of the submarine. An external manipulator held a large steel hook which was connected to the end of the rope. Each sphere had been anchored in the water column by 18.29m (60 feet) of heavy chain. When the hook grabbed the chain, the Seacliff started to surface, paying out the nylon tagline. At the water surface, the line was buoyed with a marker.

The CEL warping tug then reeled in the line and the spheres surfaced easily. A special wire-rope sling designed by laboratory personnel was placed around the models for safe transfer from the water to the work boat. Once aboard, the spheres were wrapped in wet burlap and plastic sheets to keep them damp.

ONE OF THREE CONCRETE spheres is retrieved after more than five years in the deep ocean. All three models were virtually watertight and suffered no deterioration. The Civil Engineering Laboratory, Port Hueneme, Calif., is conducting a long-range study of deep ocean concrete structures.

What is the status of the remaining 15 spheres? Haynes said three of them have imploded, which was expected. However, others at similar depths have not failed. For example, two had been emplaced at 1,524m (5,000 feet) and yet only one has failed at this depth. The reason is "scatter of data from long-term loading tests such as the ones we are conducting," the engineer said.

Some ocean engineers now believe that within a decade, large concrete structures with diameters up to 30.48m will be built on the ocean floor. The laboratory's study into concrete is contributing much to the technology.

A Rolling Lab Gathers Data

• Port Hueneme, Calif.

A portable laboratory is ready to roll to military bases throughout the western states for accurate measurement of energy consumption.

The Energy Data Mobile Laboratory (EDML) conceived and developed by the Civil Engineering Laboratory (CEL), Naval Construction Battalion Center, Port Hueneme, Calif., takes field measurements of a shore facility's usage of electricity, natural gas, steam, fuel oil, and hot water.

The self-sufficient energy data gathering system estimates the end-use and the amounts of energy consumed by large military installations. Measurements are gathered by sampling a variety of building types at a particular base with the resulting data essential to the planning of maximum energy savings and the potential of alternative energy sources such as solar and wind devices.

The portable and self-sufficient Energy Data Mobile Laboratory (EDML) stops at military bases to measure energy consumption. Developed by the Civil Engineering Laboratory, Port Hueneme, Calif., the unique laboratory-on-wheels takes field measurements of a facility's usage of electricity, natural gas, steam, fuel oil and hot water. The vehicle tows a telescoping 60-foot tower from which meteorological data can be collected.

The roving laboratory includes a large in-put out-put panel which feeds into instrumentation sensors for direct measurement. The data is then recorded in computer-compatible form. At the rear of the vehicle is an auxiliary battery power supply, trickle charged by a photovoltaic array mounted on the roof. A flat plate solar collector panel is located on the roof for space heating the interior and also used for implementation and demonstration for solar capabilities.

Another CEL innovation is included in the vehicle — an electrical power monitor which accurately makes a direct real-time measurement of electrical consumption.

A vital component of the instrumentation package is a 0-50 channel analog datalogger with digital output to interface with an incremental digital recorder. The recorder is tied into a timeshare telephone system directly compatible with on-line computer use. The EDML utilizes a series of sensors to record wind speed and direction, ambient air temperature and relative humidity, and (solar) pyranometers.

'Purchase And Removal' Pays Off

By LCDR W. V. SAYNER, JR.
CEC, USN
Assistant PWO
• NAS Moffett Field, Calif.

Faced with many obsolete facilities and no funds for demolition, Naval Air Station Moffett Field several years ago tried offering facilities for sale under a real estate disposal procedure known as "Purchase and Removal." Since then, the Station has avoided removal costs of about $50,000 and the government has earned almost $20,000 from sale of the facilities. The results have satisfied both the Station and bidders for the facilities.

Thus far, two 32.6m (100 foot) high antenna towers, five buildings, two boiler plants and about 982m (3,000 feet) of railroad trackage have been disposed of through purchase and removal contracts. More contracts are in various stages of execution.

The Purchase and Removal procedure is administered by NAVFAC EFDs under the provisions of Chapter 23 of NAVFAC P-73 (Real Estate Administration). At the time the Report of Excess Real Property (NAVDOCKS Form 2489) is prepared, the station indicates in the "remarks" section that the facility is a possible candidate for purchase and removal. After screening for possible Government and other activity reuse, the EFD solicits bids. The bidder offering the highest price for the facility wins. The contract requires removal of the facility within a specified time and may contain other provisions as required by circumstances. For example, the antenna towers contract required removal of the footings as well as the towers and the boiler plants were removed from buildings that were retained by the station. All piping and other materials to be removed were specially marked.

The piping needed for continued use of the boiler buildings was kept in place.

Close coordination and inspection by station representatives ensured only specified materials were removed. It has been found that requirements for removal of foundations can be a deterrent to bidders and should be carefully weighed against the potential salvage value of the facility before deciding to require it — if you do, you may have no bidders.

Of course you can delete the requirement to remove foundations and readvertise, but this introduces an added and perhaps unacceptable delay.

So, for the demolition work that's been awaiting funding for so long, try "Purchase and Removal" and get it done!

Surveys To Save Energy And Money

BY JOHN WILLIAMS
Energy Programs, NAVFACHQ
• Alexandria, Va.

During FY77, naval shore facilities used more energy (43% of the total Navy consumption) than either ships or planes. Over $400 million went to heat, cool, light, and power world-wide naval facilities. Our itemized bill included: electricity — $226 million, fuel oil — $143 million, natural gas — $40 million, and coal — $4 million.

Slowing down escalation of the Navy's utilities budget has been a strong motivator for energy conservation, and is the goal of the energy conservation survey program.

Shore facilities energy management surveys, an extension of the Navy's traditional utilities conservation surveys, started with the Chief of Naval Operations in 1974 directing the commander of NAVFAC to survey all shore facilities.

NAVFAC's survey program identified a backlog of projects with an average payback on investment of only 4 years. Congress then authorized in the FY76 military construction bill, $28 million for the Navy's portion of the Dod Energy Conservation Investment Program. The $7 million annual savings from this investment will help cut escalating operation and maintenance costs.

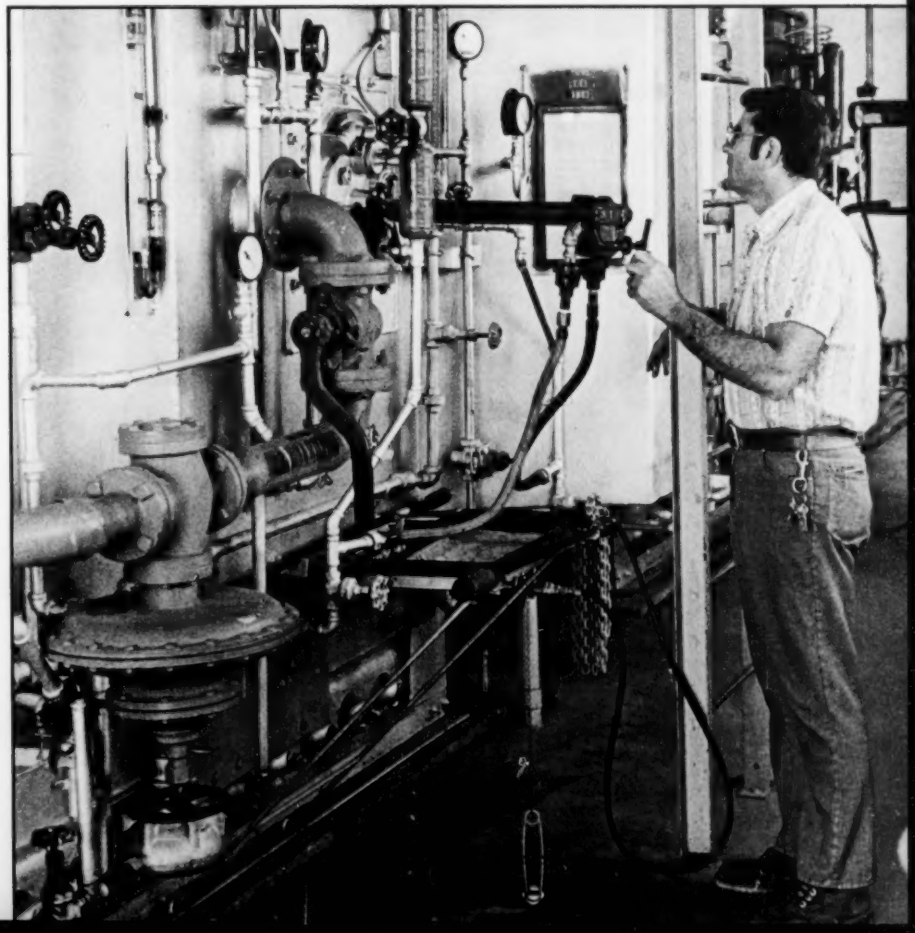
While a $7 million dent in a $400 million annual utility bill may not sound like much, FY76 was only the first year of a $330 million planned multi-year program. Congress approved $52 million in projects for the Navy's portion of the FY77 program with promised annual savings of $14 million, and $26 million in projects for FY78 with a savings of $6 million. The point of diminishing returns has not yet been met. Over the next few years, shore facilities are planned to be gradually retrofitted with energy savings modifications to allow the greatest energy reduction economically possible.

Navy-Wide Surveys

Most Energy Conservation Investment Program projects have, so far, been identified by over 250 surveys of naval activities conducted by sixty energy conservation engineers from six regional offices in Philadelphia, Washington, Norfolk, Charleston, San Francisco, and Honolulu. The engineers are primarily mechanical, electrical, and industrial; augmented by architects as necessary.

Surveys are continuing and some activities have already been surveyed twice. A third or fourth, more in-depth, survey will be appropriate at larger activities, for as the price of energy increases, so does the opportunity for projects with good paybacks. These surveys are also addressing increasingly technical areas of conservation, such as industrial processes, use of less conventional energy sources, and more sophisticated heat recovery systems.

One of the primary functions of the regional survey engineers is to assist activity personnel in project documentation and technical review to assure equitable project evaluation. The exchange of ideas during their one or two week on-site surveys



Monitoring consumption of fuels — such as natural gas in this boiler at NCBC Port Hueneme — is a goal of energy use survey teams. The teams also look for conservation projects with good prospects for quick payback-on-investment.

Energy surveys have identified over 200 projects with potential savings of $40 million.

is the key to successful survey program.

The operational manager is beset with day-to-day problems and doesn't have the time for a "forest-from-the-trees" viewpoint choosing alternatives to present energy use methods. For example, two Naval Air Stations had a wintertime "open-hangar-door" problem. That is, when aircraft mechanics opened hangar doors, they left them open if they expected to open them again in the next half hour or so.

It didn't seem to make too much difference to the mechanics because the ceiling mounted heater units continuously directed heat onto their work sites when the doors were open. One of the Naval Air Stations put heater control interlocks so that when the doors were opened, the heater fans shut off.

The mechanics quickly closed the doors once they started to feel cold. The conservation results were remarkable. The open door time was reduced from several hours per day to several minutes. More important, the saving was multliplied as the technique was transferred from one station to the other by the survey engineers.

Savings Identification

Energy surveys have identified over 200 major conservation projects and potential annual savings of $40 million. Dividing this by the engineering manpower cost of $2 million shows for each survey dollar spent, 20 dollars of potential savings was identified. The identified projects for facilities retrofit average a four-year payback on investment.

Self-amortizing projects have so far included the following: insulation, storm windows, energy controls, heat recovery, steam and condensate line improvements, and lighting conversions. Solar, nuclear, wind and geothermal conversions have not yet been generally cost competitive with traditional conservation techniques for retrofit of our naval facilities.

The priority assigned each project is determined first by calculating a simple amortization to see how many years before the project pays for itself. Savings in operation and maintenance are included in the calculation. Then the projects are arranged in priority order by energy savings effectiveness determined by dividing millions of BTUs saved by the project cost in thousands of dollars.

The payback calculation is best explained with this example: a $250,000 investment divided by its first year projected savings of $50,000 will payback in 5.0 years. Life cycle analysis using discount factors is used for longer-term energy analysis; but for quick payback Energy Conservation Investment Program projects, the amortization payback method determines project priority for funding allocation.

New Horizons

The Navy is also starting new energy conservation methods. One promising method of reducing dependence on foreign petroleum has been demonstrated by the Norfolk Naval Base. Since 1967 Norfolk has been producing steam for the pier area of the base by burning trash as fuel. Surveys are now evaluating other naval locations for either conversion to or new construction of solid waste fueled plants.

Total and selective energy plants are being considered wherever electricity generation and steam production can be handled by existing distribution lines. The first such recent plant began operation at San Diego in 1975, with the electrical generating turbines' by-product steam used to heat recruit barracks. The plant is owned and operated by a commercial utility company on land provided by the Navy. The thermal efficiency of such a plant can reach 75% as compared with normal commercial electric generating plants and distribution lines providing only electricity to its customers at efficiencies of 33 to 39 percent.

The Navy has many thousands of family housing units now heated by natural gas; and solar heating and solar assisted heat pumps are methods being explored for possible conversion of these units in the next decade or two.

We are also evaluating additional "cold iron" pier conections to allow ships to shut down their boilers and generators, and use more efficient shore-based steam, electricity, water, and sewage systems. Such connections permit better shipboard maintenance, and an important benefit for the sailors — more shore liberty.

Contingency Plans

Contingency plans are receiving renewed emphasis as part of the surveys. Most of our activities get fuel oil from the same commercial suppliers as private industry. The Navy has also had some natural gas contracts curtailed and received less electricity during brown-outs. Preparation for such contingencies requires estimates of quantities of fuel and electricity consumed by each building at an activity, so reduction actions can be determined quantitatively. Estimated quantities are necessary because few buildings on large activities are individually metered.

Survey Training

A one-week energy management course provides training for operational; as well as survey personnel. It is conducted three times a year alternating on each coast, and uses the instructional staff of the Civil Engineer Corps Officers School at Port Hueneme, Calif., supplemented by lecturers from NAVFAC and private industry.

Energy surveys are fundamental to good management of our dollars and resources. Slowing the depletion rate of our earth's resources may even be more important than the money saved for we must consider our future need for petroleum products, such as plastics, medicines, and fertilizer. As an incentive, we can justify survey programs on money saved alone. Two cost ratios substantiate the economics: $20 identified in energy savings for every $1 of engineering survey expense, and a four year payback return on investment. Energy conservation surveys are one of the best investments a large organization, like the Navy, can make.

Seabees — Around The World

• Little Creek, Va.

"Diego Garcia construction is the highest priority work being done by the Naval Construction Force—the Seabees," said CAPT John Paul Jones, Jr., Commander of the Atlantic Seabees (COMCBLANT). "However, Seabees can be found getting the job done throughout both the Atlantic and Pacific at widely scattered locations."

Naval Mobile Construction Battalion ONE (NMCB 1) is one of eight battalions now on the line. Commanded by Commander W. A. Simmons, Jr., it has for several months been deployed to Camp Moscrip, Naval Station, Roosevelt Roads, Puerto Rico.

The 650 Seabees of NMCB 1 completed two major projects during their deployment. They finished work on a 356-man Bachelor Enlisted Quarters (BEQ) and completed construction of over 6 km (four miles) of asphalt highway.

The BEQ will house people participating in Fleet exercises and support personnel for the Fleet. The highway project enables Navy people, commuting to and from the base, to save fuel and time.

NMCB 1 sent detachments to Guantanamo Bay, Cuba; Andros Island, Bahamas; Guatemala, Central America; Diego Garcia Atoll, Indian Ocean; and Vieques Island and Sabana Seca, Puerto Rico.

Men on detachments built storage sheds, wharf walls, warehouses, and waterfront structures, and they installed mooring dolphins. They erected temporary structures for earthquake stricken Guatemalans and helped restore order from chaos.

NMCB 5, while deployed to Naval Station, Rota, Spain, was the Atlantic Alert Construction Battalion. Homeported in Port Hueneme, California, the globe-trotting battalion deploys for eight months and rotates with the other active battalions.

In Rota, where the main body lived, construction projects included the support of Fleet operations and Navy communications plus welfare and recreation facilities at the Naval Base. Top priority was the installation of a Mobile Utility Support Equipment (MUSE) "Cold Iron" system. NMCB 5 also replaced the fender system on Rota's Pier TWO.

A 13-man detachment erected two large antennas on the cold plains of Thurso, Scotland, despite North Sea winds and persistent rain. They also erected five tactical support center antennas at the transmitter site in Moron, Spain, five antennas at the receiving site in Rota, and replaced parts of a Wullenweber Antenna System. Two building additions were made at the main communication center.

At Rota, additions were built to the base library and bowling alley which doubles the size of both existing buildings.

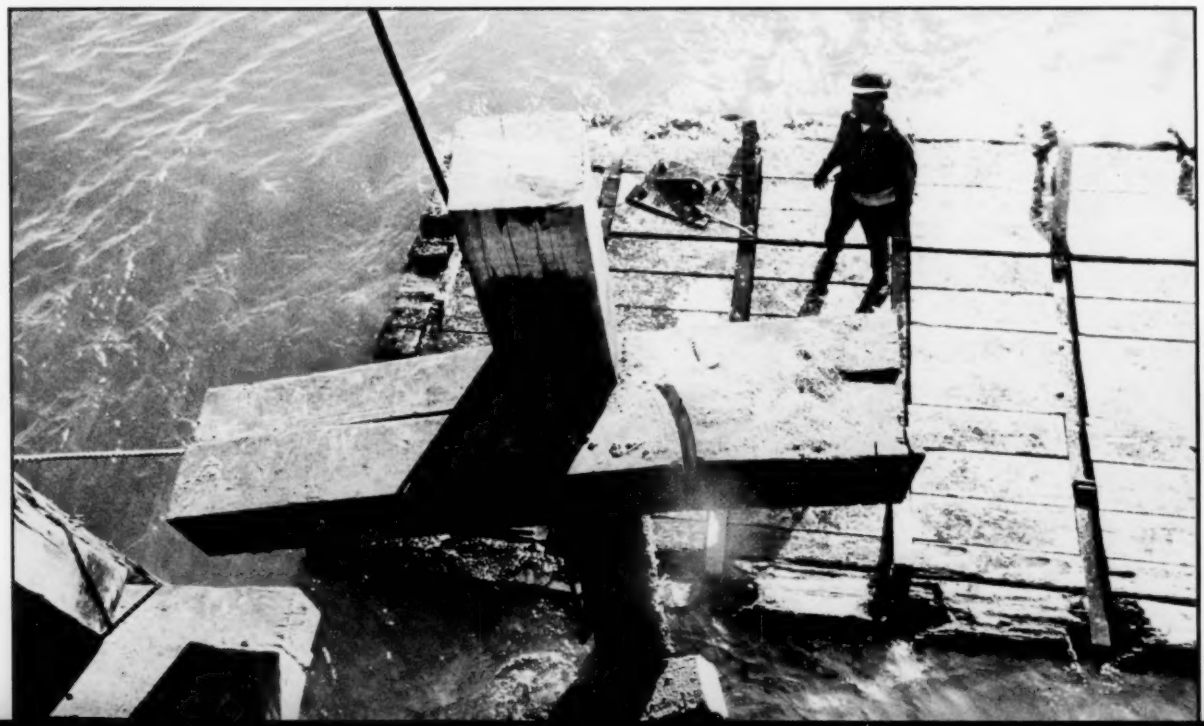
At Sigonella, Sicily, a 140-man detachment made improvements and building additions to ordnance magazines, security barriers, and a reaction force facility. This facility will be home for the Marine unit assigned there.

NMCB 5 completed improvements to the Sigonella Naval Air Facility movie theater, which were begun by NMCB-62.

Sigonella is a focal point for mail service to the SIXTH Fleet. The men of NMCB 5 began construction of a new Fleet Main Center. When complete, it will consist of two steel frame pre-engineered buildings and will provide ample mail staging and covered storage and office spaces for postal operations.

In Greece, a 25-man detachment

A SEABEE Project Chief of NMCB 5 oversees the dismantling of the old fenders on Pier II in the harbor at Rota, Spain.



MEN OF NMCB 5 (above) build a landfill at Rota, Spain, designed as civic action support for townspeople, and was done by Seabees during their free time. BELOW Utilitiesman second class Marvin Winters puts the finishing touches on concrete forms for a multipurpose building at Nea Makri, Greece. BELOW RIGHT the 356-man Bachelor Enlisted Quarters, built by Seabees at Roosevelt Roads, P.R., will house Fleet personnel during Caribbean training exercises.

at the Naval Communication Station, Nea Makri, undertook as its largest and most complex project, the construction of a new multi-purpose building. The pre-engineered steel and concrete building will provide space for a movie theater and other recreational activities.

At Souda Bay, Crete, a ten-man detachment upgraded portions of the power distribution system by replacing damaged power cables and relocating existing transformer substations. They also built a leaching field to improve sewage treatment and made urgent repairs to a BEQ which had been damaged in a storm.

Although construction is the primary mission of a deployed battalion, the requirement for continuous training remains.

Two weeks after arrival in Rota, NMCB 5 conducted an embarkation exercise with the support of the *USS Newport* (LST 1179). Embarkation training was achieved by loading and off-loading 37 construction vehicles while the *Newport* lay at anchor in the outer harbor at Rota. The vehicles were cleaned, fitted with combat equipment, and rigged for embarkation. Barged from the beach-loading site to the *Newport* using an assault causeway, they were loaded aboard the LST's main and tank decks.

NMCB 1, at Roosevelt Roads, demonstrated its fast getaway techniques. A 100-man force was ready to go by air in 48 hours. The full battalion followed in 96 hours.

In March 1977, NMCB 5 staged a six-day military training project. Amphibious beach assaults, helicopter aided medevacs, tactical marches, and vehicle convoying techniques were the mainstays of the operation.

NMCB 5 at La Maddalena, Italy, responded on short notice to the need for emergency reconstruction of a commissary and exchange which had been destroyed by fire. Airlifted from Rota, a 15-man detachment arrived within a few days with tools and materials. They rebuilt the commissary from "bare slab" in 66 days and opened the rebuilt Navy Exchange three weeks later. These two facilities provide almost all necessities for the men and their dependents assigned to Naval Support Office, La Maddalena, and the *USS Gilmore*, a Navy sub-tender which homeports there.

Following the tradition set by Seabees before them, the men of NMCB 5 have found off-duty time and energy to help the people of Rota. They refinished a lounge area in a social club for elderly people and provided food for special occasions for more than 50 of the community's senior citizens. They assisted the town of Rota on a public landfill and the construction of two roadways, one leading to a school and the other connecting two major traffic arteries.

Today's Seabees hope that the "Can Do" spirit of their WW2 predecessors is being maintained!

Navy Construction In FY78

By CDR WARREN M. GARBE, CEC, USN
E.I.T., Ind.
and
LCDR JOHN C. ELKINS, CEC, USN
P.E., La.

• Alexandria, Va.

The FY78 Military Construction, Navy (MCON) Program, enacted with total obligational authority of $528,256,000, is now grinding into gear. This program has had a turbulent life; it increased from an original $600 million in 1974 to a peak of $880 million in 1975. Sizable reductions were made by the Ford Administration through the Office of the Secretary of Defense Office of Management and Budget (Program Budget Decisions) late in 1975 and again in 1976. The 1976 reduction was intended to defer construction to allow study of the Defense-wide basing structure by a Presidential Blue Ribbon Panel.

The Office of Management and Budget deferred projects at bases which were candidates for closures or reduction; and where more than one base was performing a similar function. The Carter Administration did not pursue the Blue Ribbon Panel, but the Department of Defense has continued to study possible base realignments. The Carter Administration also restored about $50 million in Navy military construction as part of the budget amendments in March 1977.

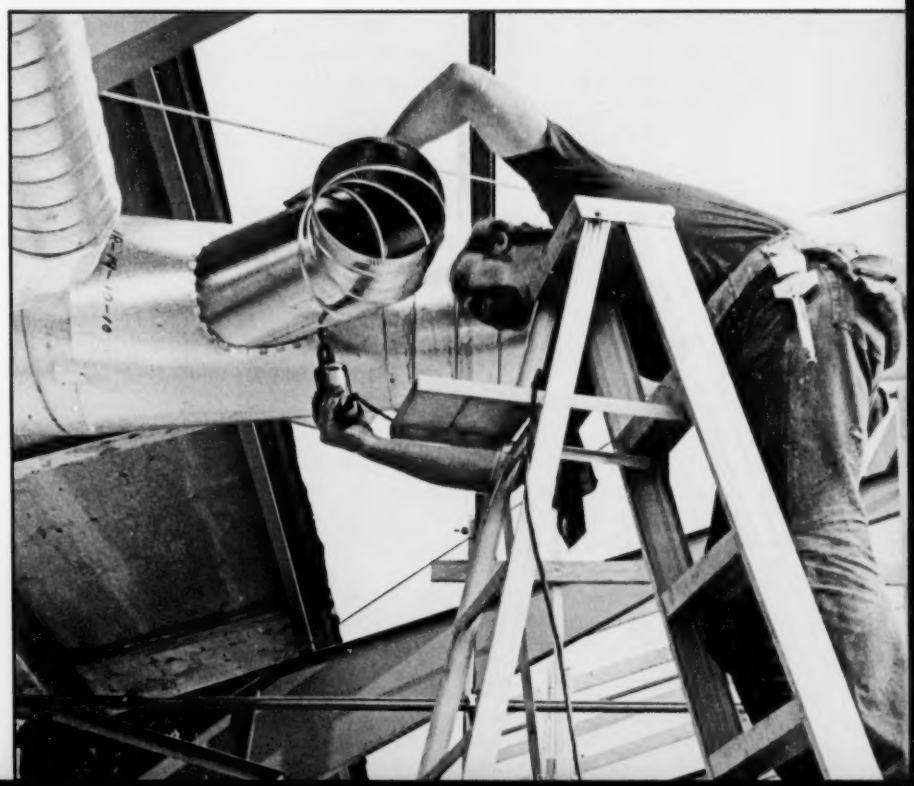
The revised FY78 MCON Program, submitted to Congress by President Carter, of $498.3 million was one of the smallest in recent years. Congressional committees were concerned by deferrals of pollution abatement and energy conservation programs. Throughout the hearings, these committees and their staff often inquired concerning addition of projects which in turn, required extensive coordination between Field Divisions and Headquarters about project development and design status.

The result of these committee hearings was an increase to the Navy program of $31.7 million for operational facilities, $15.8 million for pollution abatement, and $20.2 million for energy conservation. Most pollution abatement and energy conservation projects were those previously identified for, or whose design was well along enough to insure contract award early in FY78.

TOP TEN PROJECTS (w/o TRIDENT)

P-No.	Location	Description	($000)
P-060	NSC Pearl Harbor	Fuel Storage	13,400
P-199	NSY Mare Island	Causeway/Bridge Alterations	13,350
P-471	NSY Philadelphia	Propeller Facility	11,750
P-102	NS Adak	Supply Pier	10,800
P-363	NAS Norfolk	Runway Extension	10,300
P-243	MCB Camp Lejeune	BEQ	9,350
P-108	POMFLANT Charleston	Missile Assembly Inspection & Handling Facility	9,160
P-113	NAS Alameda	Improved Security Lighting	9,110
P-142	NS San Diego	Pier Utilities	8,166
P-052A	NNMC Bethesda	South Parking Structure	8,000

The Navy asked $19.5 million for FY78 to begin first-phase construction for the Polaris Submarine Facilities at Kings Bay, Georgia. However, construction there cannot begin until all requirements of the National Environmental Protection Act are met; clearing the way



Challenge — The Navy faces the daunting task of managing one of the smallest recent MCON Budgets — that for FY78 — and potentially the largest — that for FY79 — back to back. FY78 budget projections show about $500 million in MCON funds. That projected for FY79 now exceeds $1 billion.

for a final site selection decision by the Secretary of the Navy. Since site selection was not final at the time of the congressional submission and hearings, construction was requested on a "various locations" basis, identifying Kings Bay as the preferred site.

Because environmental impact evaluations and site selection were not completed, Congress did not approve the project, but authorized use of emergency construction authority, Section 202, once the Secretary of the Navy has made a site decision, expected in mid-January 1978. Since Section 202 is unfunded authority, it will be necessary to reprogram funds with the approval of the House and Senate Appropriations Committees from cancelled projects or from savings.

The Senate Armed Services Committee has emphasized the need for the fastest possible design completion and contract award process to minimize the effect of inflation. In response, the Deputy Assistant Secretary of Defense (Installations and Housing), DASD (I & H), has set the following goals for contract awards in FY78:

FY 1978 PROGRAM AWARD GOALS

Period Ending	OSD Goal	Current EFD Est.
1st Qtr. FY78	25%	20%
2nd Qtr. FY78	50%	80%
3rd Qtr. FY78	75%	91%
4th Qtr. FY78	90%	98%
2nd Qtr. FY79	100%	100%

The present data, as reflected in the Construction Management System (CMS), indicate these DASD (I & H) goals will be met or significantly exceeded. To accomplish this, sustained effort will be required from Project Managers at each Engineering Field Division as well as field OICC/ROICCs.

Analysis of project distribution among the EFDs also reflects the low level of FY78 program.

FY 1978 MCON PROGRAM DISTRIBUTION*

EFD	Number of Projects	Adj. Auth. ($000)
NORTHDIV	22	$ 34,820
CHESDIV	11	4,164
LANTDIV	46	63,148
SOUTHDIV	24	44,026
WESTDIV	51	125,509
PACDIV	28	62,988
OICC TRIDENT	12	80,557
OICC BETHESDA	1	8,000**

* *Does not include urgent minor construction, planning and design, access roads or funding adjustments.*

** *Authority to utilize prior year funding.*

The FY79 Program will be significantly larger; the Total Obligational Authority is now over $1 billion. If this unprecedented program level holds, we will face the imposing management challenge of executing the smallest and largest program in recent years, back-to-back. The policy guidance and goals established by Congress and the Secretary of Defense are continually being tightened to encourage the highest management performance.

ON ADVICE OF COUNSEL

By WILLIAM H. SPECK
Counsel
NAVFAC HQ

"Justice is truth in action."
—Disraeli

Truth In Negotiation (TIN) requirements imposed by P. L. 87-653 and ASPR 3-807.3 have been with us now fifteen years but must not be forgotten.

Most NAVFAC contracts are competitively bid and so not covered. But wherever contracts are negotiated at a price exceeding $100,000 without adequate price competition (at least two proposals) and at prices not determined by catalog or market prices or law or regulations, TIN applies. Thus, contract actions over $100,000 by changes, architect-engineer selection and awards, and other negotiations must be conducted under TIN rules.

Since most NAVFAC procurements are not covered (e.g., competitively bid construction contracts) or are exempt (utility services at rates fixed by public regulation), TIN rules may generally be overlooked. All construction contracts contain the TIN clauses in the subparagraph (b) series (ASPR 7-104.29) applicable only to negotiated changes exceeding $100,000, so that when such a contract is negotiated without two proposals the subparagraph (a) clauses applicable to both the basic contract and the changes must be used.

Public utility contracts are usually exempt because the prices are determined by regulated tariffs, but a connection charge exceeding $100,000 not so determined may have to be paid. If that connection charge is the Navy's share of a project competitively bid by the contractor, it is still exempt, but negotiated engineering or overhead charges are not exempt.

If TIN applies, the contractor must furnish with his proposal cost and pricing data, must certify that such data are complete, accurate, and current, and must agree the price will be reduced to the extent increased because data were not complete, accurate, and current.

To satisfy the law the NAVFAC selection and negotiating board must obtain factual, verifiable data from the contractor to support each item in the proposal —not general statements but explanations of basis and references to supporting business data—, must have the contractor execute a certificate (ASPR 3-807.4) attesting to these data, and must be sure the contract documents contain the correct clauses (ASPR 7-104.29, -.41, and -.42.).

The results of TIN should be greater accuracy and care in making and reviewing price proposals. The contractor must be sure his price proposal submitted with form DD 633 contains all the data used and available to him for pricing, and must attest to their completeness, accuracy, and currency.

The Government must audit the proposal before award and may audit after performance, and may also obtain a price adjustment for any deficiencies.

CEL Has A 'Bladder' Idea!

• Port Hueneme, Calif.

A 67.06m (220-foot) long snake-like rubber bladder containing 456,472L (126,000 gallons) of water is tethered to a mooring in the open sea off Ventura County in Southern California.

The Navy wants to determine if the Dracone (the name is derived from an ancient Greek word meaning serpent) bladder can be adapted for use as an open ocean petroleum storage facility to support Navy and Marine Corps amphibious operations.

Initial tests by the Civil Engineering Laboratory (CEL), at NCBC, Port Hueneme, Calif., have been successful. The program is a joint Navy-Marine Corps effort sponsored by NAVFAC.

The Laboratory reports that for the first time, a Dracone of this size — more than 67.06m (73 yards) long, 3.34m (11 feet) in diameter and weighing 4,545kg (five tons) in air — had been deployed at sea from a Navy vessel, an LST. During the first several weeks of exposure, the container withstood 4.57m (15 foot) waves and winds in excess of 74.03kph (40 knots), according to Norman D. Albertsen, CEL research civil engineer in charge of the project.

"Our objective is to determine if a Type L Dracone can survive long-term ocean deployment," he said. At-sea towing and handling performance tests began in mid-July.

CEL purchased the commercially-available container from Dunlop, Ltd., England. Following preliminary in-harbor load and discharge tests, the Dracone was rolled up and placed on the tank deck of the LST and transported to a point off San Nicolas Island. Once on station, the bladder was unrolled into the water through the LST's stern gate with the assistance of an LCVP boat. Before it was completely deployed, the Dracone's internal buoyancy tubes were inflated with nitrogen gas. A pair of these tubes runs the full length of the device to support it on the surface of the water when it is empty.

Roy S. Highberg, CEL general engineer and assistant project engineer, said it took two hours to deploy the container, fill the tubes and moor it to the buoy. Another four hours were required to pump 456,472L (126,000 gallons) of fresh water into the system.

When the 90-day mooring tests are completed, the Dracone will be towed the 104.6km (65 miles) from San Nicolas Island to Port Huemene. During the trip, engineers will conduct at-sea maneuvers to study towing and handling characteristics. Will the bladder respond satisfactorily after three months of exposure in the ocean? Will it snake while under tow?

Albertsen explained the Dracone load capacity must be reduced to 439,060L (116,000 gallons) for towing to reduce stresses in the bladder. Other tests will include reduction to two-thirds capacity, then to one-third capacity, and finally empty. The bladder will be towed in the final mode supported by its two internal tubes.

Serpent — This Dracone, a sea-going bladder with internal stiffening structures, is being tested by the Navy Civil Engineering Laboratory for use as an open-ocean storage facility for fuel and, possibly, drinking water.

At Port Hueneme, the Dracone will be rerolled in preparation for additional testing this year which may determine if the system is adaptable for on-land fuel storage.

The flexible container is constructed from synthetic rubber-coated nylon fabric and cord. The interior is lined with a nitrile coating which is not affected by petroleum products. The exterior is coated with neoprene to withstand abrasion, sunlight, salt water, and ozone attack.

Although the Navy's sole possible use of the Dracone bladder is for fuel storage, the device is equally suitable for transporting and storing drinking water, vegetable oils and other liquid products.

UCT-2 Installs Undersea Cables

By E. B. SPENCER
P.E., Tex.
Ocean Facilities Program Office
• Barking Sands, Hawaii

In May 1977, Underwater Construction Team Two, under the command of LCDR John A. Stamm, CEC, USN, deployed to the Naval Pacific Missile Range Facility (PMRF), Barking Sands, Kauai, Hawaii. Tasked to install two shore interface cables, UCT TWO completed the link between two sea cables, laid into the offshore range, and land cables connected to the range's operations control center. The Ocean Engineering and Construction Project Office from CHESDIV was tasked with project responsibility and provided engineering and technical support to UCT TWO for field work. In addition, equipment and essential materials were provided from NAVFAC's Ocean Construction Equipment Inventory (OCEI).

The UCT/CHESDIV team was formed in mid-March as a result of tasking to NAVFAC from the Pacific Missile Test Center (PMTC) at Point Mugu, California, which has responsibility for new installations at PMRF. To meet deadlines in a CNO Priority One project, the cables were to be installed and operating by July 15, 1977. Additional tasking in the statement of work required UCT divers to immobilize the new cables after their installation by pinning them to the ocean floor using clamps and rock bolts. Additional immobilization was requested for three cables that had been installed in 1976.

Cable Protection

Protection of cables in rough surf requires sufficient weight be added to the cable to prevent movement and damage due to hydrodynamic drag from the breaking waves. Weight and protection can be added to cables by a number of methods. Methods chosen for PMRF included double armor wires on the cable, application of cast iron split pipe in the immediate surf zone and unprotected beach areas, and pinning the cable to the bottom. Pinning was to be accomplished using commercially available rock bolts and coral rock bolts developed by the Civil Engineering Laboratory (CEL) at Port Hueneme, California. The armor wires are applied to the cable as it is manufactured and the remaining protection must be applied during installation.

UCTs have developed several methods for applying split pipe to cable on the surface to avoid the effort required to install pipe underwater. Successful installations in the past have demonstrated that pipe can be applied if the cable is brought on to the beach; the pipe bolted on, and then pulled into the sea and into final position. Other proven methods include the use of low free board surface platforms — such as ammi-pontoon sections — to underrun a previously laid cable. Once the cable is underrun, the split pipe can be installed on the deck of the platform as it is warped along under the cable. Because of the environment at Barking Sands and limitations on available equipment, these methods could not be used for the PMRF cables. The decision was made to lay the cable and apply split pipe in a single operation.

When the decision had been made about installation, intense efforts by CHESDIV and UCT TWO followed to mobilize equipment and material in time to meet the installation schedule. CHESDIV's engineers borrowed a YC barge from the Naval Station at Pearl Harbor and, with help from Naval Supply Center, Pearl Harbor, assembled and installed on board the required equipment for mooring the barge and laying cable. Also, hardware to install an in-water mooring system for the barge at Barking Sands was assembled in Pearl Harbor and placed on board the barge for shipment to Kauai.

The UCT assembled and shipped the required UCT/NCF assets to support the beach construction efforts, cable landing and subsequent cable pinning and diving operations. The split pipe, required on the barge for the cable installation, was taken from the NAVFAC OCEI and shipped to Pearl Harbor. All material and equipment were placed in shipment by mid-April and by the first week in June everything was on hand in Kauai or Pearl Harbor.

Installation

In mid-May, the advanced UCT party arrived and

Cable — UCT TWO men installing cables at the Pacific Missile Range Facility, Barking Sands, Hawaii, first had to pick up the old cable on the sea floor and load it aboard a barge. Once sections of the cable were on the barge, split pipe was installed (opposite page) to protect it from rough surf and storms.

began preparation for the cable landing. The berm protecting the beach was opened and a trench was cut across the beach in which to bury the cable to provide added protection against winter storms at Barking Sands. Excavation and construction of a cable vault was begun by the advanced party and completed ahead of schedule. UCT divers, taking advantage of the good weather at Barking Sands in May, began installation of split pipe on the range cables installed the previous year.

By the second week in June, all preparations were completed. A commercial tug, the MAMO II, owned by Dillingham Tug and Barge Co., Ltd., under contract to the Military Sealift Command Office in Honolulu, was used to move the cable barge to the site at Barking Sands. MAMO II remained at the site to assist in all the subsequent mooring, cable landing, and cable laying operations.

On June 21, the barge was moved to the offshore mooring at PMRF. This mooring, consisting of two nun buoys attached to explosive embedment anchors, was next to the planned cable track and 1.2km (.75 mile) from the cable landing site. From these moorings, seven 4,545kg (5 ton) concrete clumps were deployed from the barge. The clumps were released from hangars welded along the port side of the barge. A 7,650kg (8.5 ton) salvage pontoon was used to suspend the clumps as they were dropped one at a time from the side of the barge. Using LARC 15s, the Seabees towed the clumps to four previously surveyed and marked positions. These positions formed a four-point mooring for the barge, the nearest being approximately 305m (1,000 ft) from the beach and on either side of the intended cable track. Installation of all clumps, mooring tackle, pendants and surface floats were completed in less than eight hours.

The cable installation began early on June 25. With MAMO II alongside, the barge was moved immediately offshore from the four-point mooring. Water depth at this point was about 6.1m (20 ft) and the tug could not safely go closer to the beach. From this position, the LARC 15s were used to take the barge's mooring lines and attach them to the mooring pendants at the mooring floats. The cable inhaul line was passed from the beach and attached to the barge. The shore end of the inhaul line was attached to a TD-20 dozer on the beach. After the tug had cast off from alongside using the gypsy head winch on the barge and, with the dozer pulling from shore, the barge was warped into its moored position.

Cable laying operations began immediately. Floatation balloons, that support about 101kg (240 pounds) each, were attached to the cable as it was pulled off the barge by the dozer on the beach. This continued until the point was reached where split pipe was to be attached. Using pneumatic tools, the Seabees began attaching the interlocking pipe sections to the cable on the deck of the barge. Sixteen of the .9m (3 ft) sections could be installed at a time. While each segment of cable was being worked on, the cable was held on the barge by a hydraulic powered friction brake designed and built by UCT TWO Steelworker 1st Class R. L. Hurt.

Application of the split pipe and float balloons continued in this manner until 106m (350 ft) of pipe had been applied and floated off the barge. The floating cable and pipe was then pulled ashore by the dozer until the pipe reached its final position at the head of the beach. Divers then swam along the cable, cutting off the balloons, allowing it to settle to the ocean floor.

Following the cable landing, the tug picked up the towing line from the barge and, with assistance from the LARCs all mooring lines were cast off from the moorings and retrieved on the barge. The tug then towed the barge slowly along the prescribed cable track to a predetermined position between the two offshore moorings. With the shore interface cable now laid, the barge was placed in a two-point moor between the nun buoys. The north sea cable, which had previously been laid from the offshore portions of the range, was recovered by the UCT divers and brought aboard the barge.

Splicing the two cables together began at 1800 and was completed at 0300 the following morning. Splicing was accomplished by Simplex Wire and Cable Corporation, of Newington, New Hampshire, who were under Navy contract. On the second day, the splice was tested and overboarded. Later in the second day all preparations were completed for the laying and splicing the next (south) cable. Laying the south cable also took two days and was accomplished without incident.

On completion of the south cable installation, the barge and tug were returned to Pearl Harbor, the tug released and the barge demobilized.

Following installation UCT divers began operations to clamp the newly installed split pipe and cables to the ocean floor. Also, the shore ends of the two shore interface cables were spliced to the land cables in the cable vault. Restoration of the beach and berm was completed, thus bringing on line the new cable system ahead of schedule and within projected cost.

Ocean Facilities Program Capability

Timely completion of this project highlights the highly responsive ocean construction capability in the Naval Construction Forces. In two months, over a half million dollars in NCF and NAVFAC assets were mobilized and brought to a remote job site. The project mobilized significant manpower and technical support resources from within NAVFAC and the NCF and concentrated it toward meeting this high priority CNO requirement. Timely completion of this project underlines the planning and professional capability of the organizations involved and their ability to respond to worldwide fleet requirements for ocean construction.

Making BEQs-BOQs More Livable

By LCDR PAUL J. EPPERLY, SC, USN

• Alexandria, Va.

The Navy should be able to look back on the 1970s with a sense of accomplishment about improving living conditions for personnel. Nowhere is the Navy's achievement more noticeable than in enlisted bachelor housing, where progress has been made in increased space per man, privacy and comfort, security, and construction techniques.

DoD housing studies in 1964 and 1971 noted dissatisfaction with housing standards by occupants. It was determined this dissatisfaction greatly influenced retention — negatively. It became apparent to both the Department of Defense and Congress that efforts must be made to increase service retention. With DoD's new minimum habitability and occupancy criteria, supported by a higher allowed cost of construction per man, the Navy established in 1971 a Five-Year Bachelor Housing Improvement Program.

The BEQs constructed during that period, provide accommodations more private and comfortable than those of prior years.

Increased Space

Before 1967, the Navy constructed two and three story barracks with large open bays and central lavatories. E2-E4s were provided a minimum of 72 square feet of sleeping area or 126 square feet of living area per man. The allowed square feet per man remained the same through 1970. However, during this period, the Navy began building barracks with three to four man rooms but which still contained central living areas and lavatories. In 1971 when Congress approved DoD's proposed New Construction criteria allowing 90 square feet of sleeping area per man in the E1-E4 category, 135 square feet in the E5-E6 category, and 270 square feet in the E7-E9 category, the navy adopted several new BEQ designs providing maximum loading flexibility. Sleeping rooms in the new BEQs contain 270 square feet, accommodating three E1-E4s, two E5-E6s, or one E7-E9. In addition, each room includes a private bath. Although various BEQ designs are available for selection, the Navy Welton-Beckett is the design most often used since 1972. This design features a module of four bedrooms with private baths, surrounding a small central living room.

Privacy and Comfort

As the allowed space per man increased, comfort also increased. Rooms are well furnished, brightly decorated, and limited to a specific occupancy level. The small central living rooms in each module provide a place where occupants can socialize or watch TV without disturbing roomates who desire to sleep. Carpeting, curtains, and paintings have brought aesthetic warmth into the rooms, while air conditioning has added comfort and helped reduce outside noise. Bachelor Enlisted Quarters in the future will most likely also be furnished with television sets and small refrigerators.

In addition to the small living rooms, central recreation rooms and lounges have also been retained so BEQ occupants have a place to entertain guests. Controlled central storage rooms, cleaning gear and linen lockers, fully equipped laundry rooms, concession areas, central office space and attractive front desk areas are also standard fea-

Accommodating — The Navy Welton-Beckett modular barracks for enlisted personnel is a model of efficiency and comfort. Three-man rooms allow privacy and the lounge allows socializing. Each room can accommodate three E-1—E-4s, two E-5—E-6s, or one E-7—E-9.

tures of the Navy's new Bachelor Enlisted Quarters.

Although privacy and comfort were the two complaints cited most by occupants in DoD housing studies, a need for increased security of personal possessions was also voiced. By limiting the number of occupants sharing a room, and installing locks on doors, security has been greatly improved. In addition, rooms now include built-in hanging lockers which allow occupants to secure smaller and more valuable possessions. The Navy Welton-Beckett BEQ design has also been recently revised, relocating the central living room, eliminating the need for the emergency fire exit doors presently in the lavatories, leading from one module to the next. The new design not only increases security but eliminates the living room from being used, largely, as a passageway to the bedrooms.

Construction Progress

Over 130 bachelor quarters projects have been or will be constructed or modernized with funds authorized in the 1971-75 MCON programs. These quarters will provide accommodations for nearly 46,000 personnel at a cost of over $244 million. Eighty-six percent of these quarters are to satisfy requirements in the E1-E4 category while new Bachelor Officer Quarters (BOQs) represent less than two percent of total construction. The 1976-77 bachelor housing programs should provide accommodations for an additional 3,600.

In view of the number of quarters constructed during the Five-Year Bachelor Housing Improvement period, it would be easy to assume that the Navy's bachelor housing problem should be solved or well on the road to recovery. This would be incorrect. Based on a world-wide survey comparing minimum OSD habitability criteria to existing bachelor housing assets, the Navy's post-FY76 bachelor housing programming deficiency exceeds space required for 70,000 personnel. Estimated cost of correction is over one-half billion dollars. Correction of a deficiency this large through construction of military quarters is becoming increasingly difficult as a result of rapidly escalating construction costs and shrinking annual MCON funds.

Bearing in mind the fact that three DoD housing studies over the past 10 years have indicated an overwhelming desire by a majority of enlisted bachelors to live off-base in private housing, it is easy to understand the reason behind the new bachelor housing programming guidance recently set forth by the Office of the Secretary of Defense (OSD). In the past, written guidance from OSD allowed the Services to program construction of military bachelor housing for 100% of the average projected transient requirement and up to 90% of the projected permanent party requirement. Programming emphasis was placed primarily on projects providing adequate quarters in the E1-E4 rates.

Verbal guidance from OSD reduced the programming percentage of the permanent party requirement from 90% to 75% beginning with the FY75 MCON program. In determination of an activity's programmable deficiency, adequate community private housing was considered as a main source of assets. The sum of a community's housing, determined to be adequate for bachelor occupancy, plus the activity's on-base bachelor assets comprised the activity's total bachelor housing inventory. A comparison of this total inventory to the activity's requirement provided the activity's bachelor housing deficiency.

New Guidance

Under bachelor housing programming guidance, overseas activities will be allowed to program 100% of their projected average transient requirement and up to 90% of their projected permanent party requirement, including "Geographic Bachelors." The rules for programming bachelor housing at CONUS activities, including Hawaii, have been considerably revised. It is OSD's desire that the services program military bachelor housing for all permanent party enlisted bachelors who prefer living on base, except "Geographic Bachelors," in addition to programming for transients and to meet requirements.

This means determination of an activity's bachelor housing requirement may be considerably affected. First, rather than using community bachelor assets in developing an activity's total bachelor housing inventory and programmable deficiency, it will be necessary to incorporate and reflect the results of a personal preference survey of permanent party personnel in the activity's projected bachelor requirement figures. Second, bachelor housing will no longer be programmed for "Geographic Bachelors." Third, the term "Military Necessity" is largely undefined. Members falling into this category will differ from one activity to another. Fourth, there still remains a bachelor housing requirement for personnel who are not eligible for BAQ but who fall into a requirement category which can neither be considered as transient nor military necessity, such as personnel assigned to small ships and to submarines.

The revised OSD bachelor housing programming guidance is presently under review at OPNAV, as is the most recent OSD/OMB housing study. This study, which was concluded in October 1975, dealing with such subjects as Bachelor Housing Management, Optional Residency, and Fair Market Rental, was the basis of the recent OSD bachelor housing programming memorandum. The impact has yet to be determined, however, certain conclusions can be drawn. Greater numbers of enlisted personnel will be living in the community in the future. The MCON backlog of required Bachelor Enlisted Quarters will be reduced while the requirement for additional MPN funding to pay BAQ will increase. Within the year, the services will be instructed to provide additional management information consisting of BEQ/BOQ utilization data and operations and maintenance cost data. OSD has also served notice of their intention to visit each location where there is a proposed Bachelor Housing MCON project. Of interest to OSD will be the condition and use of existing assets, availability of community assets, and the preference for housing indicated by the activity's bachelors. If warranted, OSD will adjust the scope of proposed projects as deemed reasonable.

Revised Navy bachelor housing programming guidance will be issued by OPNAV in the near future.

Hi-rise — Distorted by the lens, these new high rise apartments for Navy families stationed in Yokosuka seem to tower into the sky. Each building has 48 two-and-three bedroom apartments for enlisted personnel.

Japanese Housing Is Getting Sky-High

BY LT C. EUGENE TALMADGE
CEC, USNR
Public Affairs Coordinator

• Yokosuka, Japan

An open house and ribbon cutting ceremony marked a significant step in the changing appearance of Yokosuka, Japan. The first three of six high-rise apartments were opened for occupancy just before Christmas. The building completion marks a milestone of construction under the Yokohama Housing Relocation Program (YHRP). YHRP involves the construction of new housing and other support facilities at Yokosuka Naval Base by the Government of Japan in return for the release of land and other facilities in the Yokohama area.

Officials of the Government of Japan presented a ceremonial key to the buildings to Rear Admiral T.B. Russell, Jr., Commander U.S. Naval Forces Japan who, in turn, presented the key to the first three occupants' wives.

Each nine-story "Y"-shaped building contains six apartments per floor in the second through ninth floors. The first floor has an entertainment room, a multi-purpose room and storage areas for the tenants. Each apartment consists of two bedrooms, a living-dining room, kitchen, bath, laundry area, pantry and balcony-patio. The building core contains a stairway, an elevator, and the mechanical and fire fighting systems.

The buildings have central forced air heating; and a program sponsored by the U. S. Government provides central air conditioning. The fire protection system is extensive and includes both dry and wet-pipe stations at each floor, as well as smoke detectors in each apartment connected to a central alarm-indicator panel on the first floor. The alarm system is also tied into the central base system. The design of each building provides each tenant with two different fire escape routes.

The open house was sponsored jointly by the Public Works Center Housing Office and the Navy Exchange. Four of the apartments were decorated for the visitors to see and representatives from the Housing Office were available to answer questions. Three of the apartments were decorated in traditional western furniture but the highlight was the one appointed in traditional Japanese motif, complete from tatami mat floors to a small garden set up on the balcony.

To add decorum, three Japanese women dressed in traditional kimonos performed a Japanese tea ceremony for the visitors. In all, 1,285 adults and many children attended the open house and many voiced pleasure with the units.

Assignment and occupancy began immediately following the week-end ceremony. All units are designated as senior and junior enlisted quarters and the initial occupancy was from the existing one and two-bedroom waiting lists. The majority of the 288 total apartment units will be filled by families relocating from Yokohama Government housing with the balance coming from private rentals on the economy.

The "sudden" increase in the on-base population has been anticipated by many of the support functions, such as the Navy Exchange, Commissary, Medical facilities and recreation facilities. Shoppers and other patrons will have to endure some longer waits in lines and some inconveniences but the outlook isn't dim. Keyed with the construction of the new housing the YHRP program provides for construction of many new support facilities including a new exchange-commissary complex, athletic facilities improvements and recreation areas.

The remaining three Tower Buildings were also completed in February 1977 and immediately opened for tenants.

Tradition — All but one of the new apartments had western-style furniture. The remaining apartment was decorated with traditional Japanese motifs and served as the setting for a tea ceremony honoring opening of the new units.

Automating Building Service Systems

Automating systems may be the answer to demands for better service and lower costs

By LT JAMES K. CHECKOVICH, CEC, USN

• Bethesda, Md.

As a part of the medical modernization program at Bethesda, a Central Building Automation System (CBAS) is being installed. The system will combine the fire alarm and smoke management, security, voice communications, and electrical/mechanical equipment monitoring and control functions. All are usually separate, hard-wired systems. But during the early design stages, several deviations from the conventional were found to have enough merit to warrant installation of a CBAS.

First, the buildings to be constructed included the Hospital (82,000m^2 — 881,000ft^2), the Uniformed Services University of the Health Sciences (79,500m^2 — 850,000ft^2 for all four increments), Utility Plant Modernization (114,000kg/hr — 250,000 lbs/hr steam and 8,200 metric tons — 9,000 tons cooling) plus new parking structures, public works expansion, old hospital rehabilitation, and other buildings still in the planning stages, such as a Navy Exchange, Animal Research Facility, BOQ, and more. Any type of control/safety system installed had to be flexible enough to meet the needs of this quickly growing complex.

Second, the new buildings needed fire and security monitoring functions. To provide these with conventional systems, using hard-wired alarm panels, would have required excessive space, both in the buildings they served and the central location to which it was planned to bring all building alarms.

Third, optimized mechanical and electrical equipment use was attractive, particularly because of rising energy and manpower costs.

Thus, the number of new facilities, the locations at which information was to be displayed, the types of information, the flexibility requirements, and available space all played a role in the decision of the OICC, Bethesda, headed by CAPT C. C. Myers, Jr., to install a CBAS. Initially, there will be seven buildings connected to the system, with an ability to add as many of the future or existing buildings as may be desired.

Each building will have sensors and panels (for our purposes the term field terminal panel or FTP is used) to which these sensors are wired. The panels are connected by a loop (coaxial or two wire) cable to the central systems. Communication between the FTP and the central equipment is by a multiplexing system. The loop system allows signals transmission even if there is a single ground or break in cable.

The central system's equipment consists of a processor and computer which have the programs necessary to respond to any planned inputs.

Each building will also have the equipment for record keeping and operating interface with the system. This equipment consists of a keyboard for operator communications with the system, a cathode ray tube screen for visual information display from the system, printers for logging alarms or running status reports, a graphic display projector with system schematics for points monitored shown, and closed circuit TV for the security system.

This system can be the most powerful tool any building manager has ever had at his disposal.

The fire alarm and smoke management system uses conventional monitoring devices such as thermal detectors, smoke detectors, and manual pull stations. The advantage of the CBAS is the complexity of responses to an alarm.

Normally, air handling systems serving an area with a fire will shut down. With the CBAS, the supply air dampers in the fire area are closed and the return air dampers surrounding the fire area are closed. This pressurizes the area surrounding a fire and depressurizes the area of the fire. Exhaust fans then vent smoke from the fire area. All fire doors are released, alarms are sounded and sent to desired operator terminals, and elevators are captured and sent to a safe floor. With the communications system also hooked into the CBAS, it is possible to broadcast prerecorded instructions to personnel in and around the fire area.

Are all these reactions necessary? In a hospital where many people cannot move themselves, everything that can be done to aid their movement and protect lives is vital. The more a building system can aid this effort, the more lives can be saved in the event of fire.

Communications and security systems are also on the CBAS. The CBAS is used as a communications organizer allowing any speakers or groups of speakers to be connected to broadcast messages. The security system, using conventional monitoring devices, such as magnetic switches and motion detectors offers an advantage in that printers will log an alarm and also acknowledgment by security personnel. These alarms can be printed at several locations, providing several hard copies of alarms and their acknowledgment.

The fire alarm and smoke management system, communications system, and security system are all fairly straight forward. An alarm is received and a preprogrammed set of responses takes place. The final subsystem to be included is not quite so straight forward and provides the greatest opportunity for innovation.

The CBAS system has several functions in mechanical-electrical systems monitoring and management. It will note abnormal conditions and optimize, or provide the information to optimize, equipment use to reduce energy consumption. It will also provide the information necessary to optimize maintenance functions. The

CBAS performs this through use of various programs and information handling.

The first of these programs is enthalpy control. Through inside and outside temperature and humidity readings, the system chooses whether it requires less energy to cool outside air or return air for use as supply air to the air conditioning system. The CBAS chooses the least expensive method and sets the air supply dampers accordingly.

The CBAS will determine optimum times to start or stop heating or cooling equipment to use the least energy. It calculates this by measuring inside and outside temperatures and humidities and using information on system capacities, radiant and solar effects on the exterior and roof (both pickup and loss), infiltration and wind conditions. This type of program lends itself particularly well to the Uniformed Services University of the Health Sciences. A classroom schedule can be programmed into the CBAS and it will start and stop heating and air conditioning systems so classrooms are at the desired conditions for classes. This is a great improvement over conventional mechanical or manual systems.

The motor control program warns of change-of-state conditions such as a shut-down not ordered by the system. It will also stagger starting a group or groups of motors to minimize current peak loads on any portion of the system.

The CBAS will also have an electrical demand forecasting program which, using the trends of the last 24 hours, will project the expected demand if the trend continues. It will compare this demand against a set desired maximum and display the amount of load to be shed, the increments of load to be shed and the time at which the load must be shed to remain below the desired maximum. Shedding can be accomplished either by shut-down of non-critical loads or use of emergency generators to pick up load.

Hundreds of measurements are made on portions of the electrical and mechanical systems to obtain usage data for electricity, steam and chilled water for various parts of all the buildings. This information can be invaluable for tracking energy wasters or difficulties such as steam leaks or chilled water leaks by comparison of daily, weekly or monthly reports. These measurements also allow monitoring of the effectiveness of other conservation measures installed in the different projects. For example, the exhaust air from transformer rooms and mechanical rooms is being used as preheat for domestic hot water systems. This reclaimed heat is measured for cost analysis.

For maintenance, run time and calendar time from the last maintenance period are recorded for various motors. This program will also warn of abnormal conditions in the motors. In addition, filter pressure drop measurements are used to determine optimum time for filter change. This measurement can be particularly effective in a hospital where many expensive and elaborate filters are used and it is desirable to get maximum life while not impairing air quality.

While discussing maintenance, the importance of the measurements made and the graphic display projectors should be emphasized. When a system is not operating as it should, measurements will tell why or give a very good indication as to what needs to be fixed. As an example, if an air flow switch on an air conditioning system turns off, the CBAS will sound an alarm and have the graphic display show a slide schematic of that system and all the measuring points in that system. The operator can call for a display on the CRT screen of all the information relating to that system. If he finds everything is normal, i.e., motors are running, etc., the chances are a problem with the fan has developed — such as a broken belt. Directions can be given to the maintenance personnel other than, "Go see what's wrong." The danger of fixing things that already work and not fixing those that don't can be greatly decreased, as well as reducing the time taken to isolate a problem.

Finally, profiles of boilers and chillers, trend logs for all systems, and exterior lighting control complete the functions included on the Bethesda CBAS.

Earlier mention was made of some hidden benefits. With all the measurements, it is possible to determine the status of all systems when they go into operation. This makes it possible to tell when anyone is fooling with the systems; or to rebalance systems at some point in the future, if necessary. The second benefit is that the Public Works Officer will know of a problem on a system before the effect of that problem is known to the occupants of the area served by that system. A telephone call advising of a problem on an air conditioning system, before dampers are opened more or thermostats are changed, will further enhance the integrity and effec-

The CBAS can respond to problems faster than humans

tiveness of that air conditioning system.

To assure this system becomes a reliable tool and not a white elephant, steps have been taken to ensure government personnel get proper training in the system's operation.

Each circuit will be tested at least weekly to insure proper receipt of and response to an alarm. Complete operational tests of the entire system are required. The system installation will be phased to match with the construction schedule of the seven buildings and the contractor will operate the CBAS from the time it first goes on line, 24 hours per day, for a year. Following this one-year period, the contractor will operate the system eight hours a day until one year after the completion of the entire system.

Factory training for government personnel will be given during installation of the CBAS — 1,440 hours of "hands on" training during the first year of operation. Continuing training during the rest of the contractor's period of operation will ensure the government has knowledgeable operators.

In the event the system does have down times, all systems can be manually controlled from the mechanical rooms.

Building automation systems of today are vastly superior to the hard-wired alarm panels of the past. Their use is only limited by the imagination, resources, and capabilities of the user. The system at Bethesda will provide an opportunity to manage, control, and optimize energy usage, maintenance personnel, life — safety and security systems to the highest degree of the state of the art.

1977 READERS SURVEY RESULTS

NAVY CIVIL ENGINEER

The Navy Civil Engineer readers' survey (initially established in 1968) continues to be a valuable instrument for measuring the readers interests and desires. The completed surveys with suggestions are forwarded to the Command Editorial Review Board for study.

The 1977 survey was responded to by 245 readers and represented 1.8% of the general circulation. Of this number, 185 responded with personal comments. The percentage of response, particularly representative of the wide range of duty assignments and geographical areas, is a strong and valid indicator of general readership attitudes. Of further interest is that 44 of the respondents had contributed articles to the magazine for publication. Our thanks to those readers who participated in this year's survey.

And special acknowledgment to LT Jerry Johnson, USNR and Byron Ward, educational specialists at CECOS; LTJG George Smith, CEC, USNR and ENS Robert McClure, CEC, USNR who opened and tallied the surveys.

The Editors

I AM { 91 USN 40 USNR 25 USNR (Inactive); 38 Civilian Employee; 2 Paid Subscriber; Other 5 }

I AM ASSIGNED TO { 25 NAVFAC; 34 EFD; 20 PWC; 18 SEABEE; 19 ROICC; 12 STAFF; 21 RESERVE; 9 CBC; OTHER (specify 60) }

MY GRADE IS GS-12/13 (average) LT/LCDR (average) (Rank, GS-)

I have 17 years of accredited education (elementary, high school, college). (average)

I hold a B.S. degree in Civil Engineering (31 hold Masters and Doctorate degrees in C.E. & other

I have 8.8 years of government service (civilian and armed forces combined). (median)

I have/have not contributed articles or material to The Navy Civil Engineer. 44 have; 187 have not contributed

I have been a reader of The Navy Civil Engineer for 12.5 years. (median)

I usually read: all: 62; more than half: 143; less than half: 45; hardly any of the contents of The Navy Civil Engineer. 1

MY RATING OF THE MAGAZINE

	Excellent	Good	Fair	Poor
My *overall* opinion is	119	109	11	0
and of editorial content	101	108	29	1
and of format	116	96	16	2
and of page design	115	107	13	4
and of photographs	102	127	23	0
and of printing and paper stock	135	85	11	0
and of mailing and distribution	136	93	14	8

DELIVERY AND AVAILABILITY

215 I receive my copy through the mail.
234 It arrives in good condition.
3 It does not arrive in good condition.
22 I receive my copy through Navy distribution channels.
67 Copies are easily and readily received.
10 Copies are not easily obtained.

OF THE STANDING FEATURES

	I READ	DON'T READ
Speaking from Topside	202	21
On Advice of Counsel	164	72
NAVFAC SitRep	192	26
PW Tek Notes	164	53

ARTICLE PREFERENCES

	I LIKE	DON'T LIKE
Research and Development	173	29
Management	186	22
Education and Professional Development	177	20
Engineering and Construction	192	8
Technical Articles	167	31
Seabee Operations	161	36
Reserves	94	75
Environmental Subjects	169	32
Energy Management	180	28
Housing	110	60

FREQUENCY

I prefer to receive the magazine
69 Monthly
43 Bi-monthly
111 Quarterly

"reflecting the fine

While the long recognized hallmark of the Naval School, Civil Engineer Corps Officers, (CECOS) has been its warm and friendly atmosphere it doesn't mean that it has lost its military bearing!

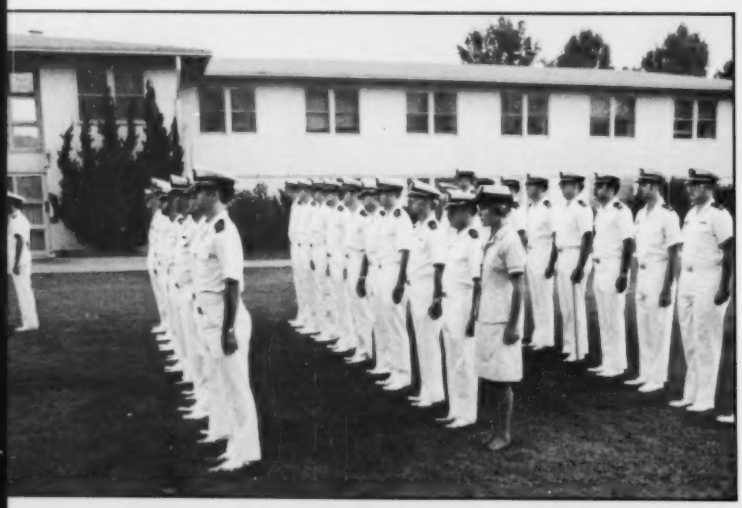
From the raising to the lowering of the national colors (left) student officers participate daily in the many mani-

below is inspected by LCDR Edward
professor of military readiness at C
traditions of inspecting officers (la
facial expression leaves the question '
the scrutiny?' They did.

LCDR Hamm conducts sword dr
students preparing them for a for
CECOS' graduations are also formal
graduation speaker normally of flag r
of the Civil Engineer Corps.

CECOS also believes in showing th
to the retirement of one of their own
bottom) is the formal farewell given t
officer of the command, Al Santana
to right) CAPT R. E. Quinn, executi
struction Battalion Center; CAPT
manding officer of CECOS, retiring M
CDR H. W. Filbry, CEC, USN (Ret)
ing management CECOS and featur
(Sel) William Harris, CEC, USN,
CECOS and master of ceremonies.

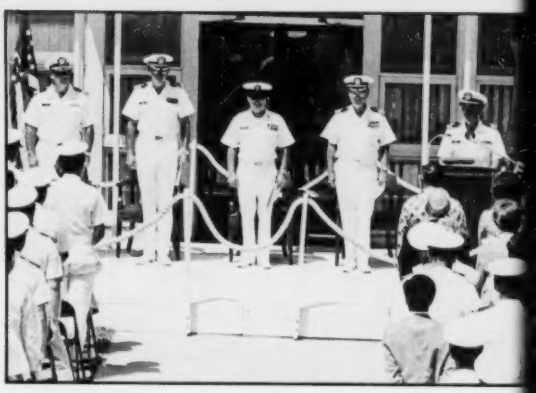
CAPT Lawson presents retire
traditional Godspeed to Master Ch
never forgets the Navy wives as att
tion to Marge Santana of a special
her contributions to the outstanding
husband. And, in the finest tradition
tions, Master Chief Santana is sal
poraries and superiors as he concl
enviable Naval career.



ıest Naval traditions"

festations of Naval customs and courtesies.

The normally small enrollment permits particular personal attention to the students by faculty and staff. And where formal personnel inspections are frequent (below) it isn't unusual for a small group to join the commanding officer for a relaxed informal luncheon. The formation



lward Hamm, CEC, USN, at CECOS. In the finest rs (last photo below) his tion 'did or didn't they pass

rd drill (right) for selected a forthcoming formation. ormal ceremonies with the flag rank or senior captain

ing the way when it comes r own. Shown right (top to iven the master chief petty ıtana. Top photograph (left xecutive officer of the Con-APT Leroy Lawson, com-ring Master Chief Santana; (Ret) professor of engineer-eatured speaker; and CDR USN, executive officer of es.

etirement certificate and r Chief Santana. CECOS is attested by the presenta-ecial certificate recognizing nding Naval career of her aditions of the Naval tradi-is saluted by his contem-concludes 30 years of an

ALL VOLUNTEER FORCE

AN OPINION
By
T. C. MURPHY
Professor Emeritus
CECOS

Much of the current discourse regarding defense costs seems to me to be composed of spurious economics, superstition and non-sequiters. Three redundant themes have emerged which cannot appeal to any but the uninformed. (But then, that may be the object.)

I am suspicious, since they recur so frequently. Are they part of a concerted program of subtle advocacy masquerading as public information or education? Is there a campaign underway to mobilize public opinion on the side of a dubious proposition? Are we being set up for a 'solution'? It wouldn't be the first time.

All three of these themes find the same culprit — people costs; all three suggest that our national security capability will be damaged unless manpower costs are reduced; and each of them implies or suggests that restoration of the draft will somewhow bring defense manpower costs down.

Theme No. I: To quote a news service: "We will either have to return to the draft or open the national pocketbook for the sharp budget increases that will be necessary if the military services have to compete with the private sector for manpower."

This amazingly shallow proposition is interesting because of the philosophy it exposes. It announces in simple terms that the nation cannot afford a volunteer military force in peacetime; and further that the first law of scarce resource allocation should be suspended. (i.e., The armed services should not be required to compete with the private sector for manpower because that is what makes it so expensive.)

Who says we cannot afford the All Volunteer Force (AVF)? Since 1968, defense costs as a percentage of gross national product have been reduced from 9.6% to 5.8%; and as a percentage of federal outlays from 44.4% to 24.8%. This is a dramatic decline and is unmatched among major federal department budgets.

And who says it's wrong to let the law of supply and demand set the price of military manpower? At least, we would then know the real cost of national defense. We have outlived the philosophy which permitted people to be systematically undervalued for military purposes.

Theme No. II: "Military pay has risen 194% since 1964 and personnel costs now account for 60% of the defense budget. That means less money is available for research and development, new weapons and equipment modernization."

This particular theme raises three points, each interesting, and each worth examining.

The first has to do with the improvement of military pay from the shameful levels of the early 60s. Then the income of several hundred thousand military families was below the official poverty boundary. Most Americans hope *that* inequity has been permanently redressed. Further, the increase in pay was accomplished during the same period when the defense share of federal outlays was almost cut in half!

The 194% increase in military pay is not particularly shocking, as some would have us believe, as the military had so much catching up to reach an equitable level of compensation. Remember — there is no such thing as *overtime* in the military. Several million men put in a lot of overtime in Vietnam. Forty-five thousand put in *all* their time.

The second point of Theme II — (60% for manpower) — suggests that some natural law has been violated when military people cost more than military things. But wait — this is a *budget* figure — later, when hardware contract cost-over-runs have been added up, this 60% may be revised downward.

The subject of cost-over-runs could be discussed; but their dimensions, frequency and causes deserve to be examined later and comprehensively. Military payrolls, on the other hand, have no history of over-runs.

The third point raised by Theme II — (less money available, etc.) — insults the intelligent reader. It pretends that after payrolls have been met the defense department must 'make do' with whatever is left for military hardware; planes, weapons, ships, etc. This is nonsense.

Theme III claims — (sometimes directly, sometimes by implication) — that the 'solution' to the 'problem' of manpower costs is restoration of the draft.

This proposition depends upon two notions.

1. Americans will permit abolition of the AVF in favor of a draft in peacetime.
2. Compulsory military service require the costly program of benefits to induce voluntary enlistments and present military pay levels would not have to be maintained.

Both of these are false premises.

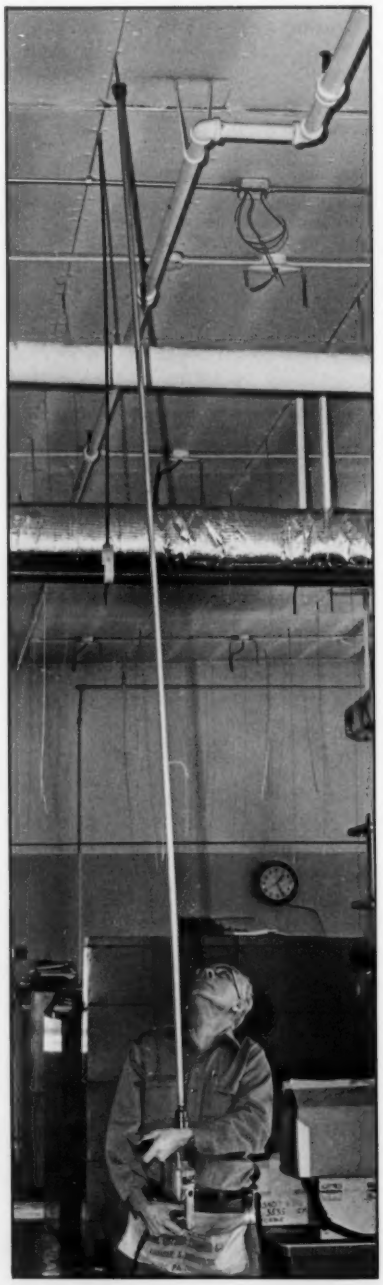
Americans sickened of the draft because of its compulsory servitude and its discriminatory deferment which imposed an artificial representation of U.S. society upon the armed services.

Today, by contrast, the AVF is remarkably representative of the nation in terms of region, race, and the family income of volunteers.

In the matter of 'savings' to be achieved by returning to the draft, Army Secretary Clifford Alexander recently said: "The volunteer Army is cheaper than a draft Army because we can avoid the internal

(Continued on page 46)

Eliminate Scaffolds And High Ladders



The present practice of installing lag screw eyes for suspended ceilings is to build scaffolding or to use high ladders among pipes, electrical wiring and duct work. Each time the scaffold has to be moved, it must partially be dismantled to accommodate the pipes, electric wiring and ducts overhead, thus creating the time consuming task of constructing the scaffolds many times.

A new tool requires the installer to fasten the wire to the screw eye, inserting the wire in the tube and locking the lag screw in place. It permits the worker to stand on the floor and hang the lags and wire in one operation with the tubing fastened in a 9.5mm electric drill. When the lag is screwed into the wood, a slight tug of the tube releases the lag and wire.

This new method eliminates the scaffold and high ladders, creates safer working conditions and conserves time.

Additional information may be obtained from LT H. D. Ellis, CEC, USN, Navy Ships Parts Control Center, Mechanicsburg, Pa., Autovon 277-3312.

LAG SCREW INSTALLATION in high places (left) is made easier with a new tool. Shown below are the tool with a lag screw inserted and the tool with lag screw locked in.

Energy Savings Tips For Water Heaters

For existing electric water heaters, the installation of additional insulation through use of a commercially available kit will provide energy savings of the same magnitude as the new energy saving water heaters. A standard paper-backed fiberglass insulation (about 8.89cm thick) could also be used if a commercial kit is not available.

Other ways to improve the energy efficiency of domestic water heating systems are to lower the water temperature settings, insulate exposed hot-water plumbing, and alter the heating cycle by automatic shutdown during periods of little or no use.

Lowering the water temperature will provide a 2% to 5% fuel savings per year per 5.6°C reduction. Systems should normally be operated to provide temperatures shown below:

- General use: 60°C (This may be reduced to 37.8°C in locations where hot water is used only for washing of hands.)
- Automatic dishwashing in mess facilities: 60°C
- Final rinsing of dishes and kitchen utensils in mess and diet kitchens: 82.2°C
- Family Quarters: 60°C
- Laundries: 60°C

Additional information may be obtained from R. K. Middleton, Code 102H, LANTDIV, Autovon 690-7121.

Temporary Pavement Markings

Whenever there is a need to mark up pavement for a short period of time, as for temporary traffic rerouting or warnings, the use of "whitewash" should be considered.

There is little use for whitewash (slaked lime in water solution) nowadays. but its bright finish, low cost, easy application, short life, and self-eradication could be an answer for these particular needs. There are no known rules for application of whitewash over pavement; surfaces to be covered (bituminous concrete, preferably), traffic volume and geographical location would govern.

In a private experiment, about a nickel's worth of garden-type lime (57% calcium hydrate) in a water and salt solution was applied on an asphalt driveway. About a week later, under minimal traffic and in generally dry weather conditions, most of the markings were well on the way to oblivion.

Application over streets or roadways where temporary, short-lived directional lanes or parking is needed, may be worth investigation.

For additional information, contact Robert A. Rivers, Code 4121.1, D. W. Taylor Naval Ship Research and Development Center, Autovon 281-3451.

Hours-old whitewash

Whitewash after seven days

Dust Control

Since the 1920s, spent sulfite liquor (SSL), a lignosulfonate derived from the acid bisulfite pulping of wood, has been used in Europe and North America for treating dirt roads.

A lignosulfonate product in the form of concentrated water solution is extremely effective as a dust control agent. It is particularly useful on dirt roads, parking lots, exposition grounds, construction projects and any other areas where dust control is necessary.

The product is shipped in the form of a concentrate containing 50% solids and is diluted with water, usually to 25% solids or lower, prior to use. The dilute solution is then sprayed on the road surface to saturate the dust and surface soil, using a tank truck fitted with a spray bar, either pump or gravity fed.

It is non-toxic, non-corrosive, and neutral in pH. It may be stored in mild steel, concrete or wood stave containers. Its high water solubility facilitates cleaning of equipment after use.

Additional information may be obtained from A. S. Gallup, Code 102A, LANTDIV, Autovon 690-7121.

Electrical Maintenance

NFPA Publication No. 70B, Electrical Equipment Maintenance, 1975, is available from National Fire Protection Association, 470 Atlantic Avenue, Boston, Massachusetts 02210. For the last few years, this existed as a tentative publication, but it is now in final form.

Unlike NFPA No. 70, National Electrical Code NFPA No. 70B is not mandatory, but it contains excellent guidance for proper maintenance. It is recommended as a maintenance tool for every Public Works electrical shop.

Additional information may be obtained from D. N. Rodgers, Code 102C, LANTDIV, Autovon 690-6121.

NAF Funds For Recreation

By SID REGEN

• Alexandria, Va.

Bowling alleys, hobby shops, swimming pools, and open messes form the bulk of the significant design and construction program financed by nonappropriated funds (NAF), sponsored by the Bureau of Naval Personnel (BUPERS) and executed by the Naval Facilities Engineering Command (NAVFAC).

The special services program objective of BUPERS is to provide Navy personnel and their dependents a varied program of wholesome and constructive off-duty recreation activities. NAVFAC, through its six engineering field divisions (EFDs), acts as the technical agent for all BUPERS design and construction projects in the special services program. NAVFAC's execution responsibility covers new construction, maintenance, and alteration projects funded with nonappropriated funds.

"What are NAF funds and how do they relate to the BUPERS design and construction program?"

NAF funds are simply monies other than those appropriated by the Congress of the United States. These dollars come from profits earned by Navy exchange facilities, a portion of which is kept at the activity for disbursement to various types of local recreation funds, and a portion is placed in the BUPERS central fund. This central fund becomes the revenue source for all major construction projects authorized and funded by BUPERS.

Projects for new construction or major rehabilitation of recreation facilities are included in each activity's five year military construction program, the facilities master plan, and the annual construction program request submitted by the commanding officer.

A tentative annual construction program is developed from all such activity requests and then a list is submitted to the Board of Administrators, BUPERS Central Recreation Fund, for tentative approval and inclusion in the annual program. NAVFAC executes the technical aspects of this program by instructing the cognizant EFDs to develop program engineering documentation and final plans, specifications, and cost estimates.

On a semi-annual basis, a listing of projects is submitted to the Armed Services and Appropriations Committees of the Senate and House of Representatives informing them of BUPERS' intention to fund construction projects. If there are no congressional objections, the final plans and specifications are completed and the EFD advertises and awards construction contracts.

Since 1974, NAVFAC has managed the design of 113 projects having a construction value of $57 million and is in the process of managing a new group of project designs valued at $19 million for FY77 and $5 million in FY78. These initiatives will extend the future year design policy of NAF projects for the first time. It is expected that this method will permit FY78 construction undertakings to be advanced a full year boosting the Navy's recreation program.

Deployments For Seabee Team 4010 Are 'Remote' Prospects

The 31st Naval Construction Regiment at the Construction Battalion Center, Port Hueneme, Calif., has a well-earned reputation for training and supplying the famous Seabee Teams that have deployed to remote Pacific locations for ten years. That tradition may come to an end, at least temporarily, with Seabee Team 4010 from Naval Mobile Construction Battalion 40, training completed at Port Hueneme.

Seabee Team 4010 deployed in January to the Micronesian island of Kusaie in the Trust Territory of the Pacific Islands. The battalion's main body is deployed to Guam, 2,080km (1,300 miles) away. Currently, Guam-based battalions are the only ones in the Navy deploying Seabee Teams, and battalions homeported in Gulfport, Miss., will be there for quite some time after NMCB-40. This means that for now, Port Hueneme's Seabee Team program will be closing down . . . perhaps for good.

Like all teams, 4010 will be concerned with civic action. In addition to providing construction support and medical assistance to the local populace, the 13-man team will give technical advisory training in construction and medical programs. Taking the ball from NMCB-3's team, 4010 will continue to develop the island's road network, upgrade existing roads and continue to build an emergency landing strip. The 67km^2 (42 mile^2) island is only five degrees north of the equator, and the wet climate makes this type of construction particularly difficult.

The training is primarily concerned with cross-rate capabilities. Men of each of the Seabee rates, plus one Hospital Corpsman, must learn the basics of each other man's rate.

The men of the team were carefully screened before the final selection. Kusaie is an isolated location. This isolation means that each team member must be of sound character and maturity in addition to being physically qualified. Supplies arrive every eight to ten weeks; therefore, resourcefulness and an ability to work together are critical requirement.

The training encompassed construction, medical and Micronesian cultural instruction but omitted military (combat) training.

Despite the isolation and the lack of communications on Kusaie, the members welcome the challenges of the mission. It requires a higher degree of professionalism and versatility than are usually required of a Seabee petty officer, but the experience and knowledge gained make up for the hardships.

The enviro

• Columbus, O.

Concern for the environment—seemingly overlooked throughout the development of our modern world—has only recently been given the importance it deserves in our planning, development and construction efforts.

Evidence of the centuries of neglect is apparent: air pollution from industrial plants and motor vehicles; water pollution from municipalities; helter-skelter arrangement of construction in cities; strip mining... the list of violations seems endless.

This evidence is valid testimony to our overall lack of concern. One area which has drawn little attention due to its temporary nature is that of the construction operation itself. Only recently, with the considerations of the Environmental Impact Reports, have construction operations come under close scrutiny.

Yet, there has apparently been relatively little study done, or guidelines established, concerning the standards of the construction phases of new facilities. Most of the emphasis is placed on the end product, the facility itself and its long term environmental impact.

Perhaps a review is in order of the environmental problems during construction and examples of what has been done and is being done to protect the environment during construction.

The American Society of Civil Engineers (ASCE) is recognized as the world's largest association devoted to facilities design and construction. To concentrate the society's efforts on the effects of construction on the environment, the Committee on Social and Environmental Concerns in Construction was formed in April 1971.

This committee deals with social concerns, such as social impact, visual, historical, archeological preservation, minority and community involvement; and the physical media, that is, the effects of construction on land, air and water.

In June 1971, an ASCE policy statement was published, stating: *Environmental goals must emphasize the need for assuring a desirable*

By LT JAMES A. RISPOLI, CEC, USN
P.E., Va.
Resident Officer In Charge of Construction, NAVFAC Contracts

too often environmental damage during actual construction is overlooked

ment during construction

quality of life in the context of expanding technology necessary to sustain and improve human life. Implicit in these goals is the need to develop resources and facilities to improve the environment of man and the need to abate deleterious effects of technology on the environment.

In pursuit of this policy statement, the committee has identified the following types of pollution attributable to construction:

Air Pollution

From common construction operations.

By smoke, fumes and sprays.

Water Pollution

Spillage and waste:
- wastes from floating plant (fuel, oil, grease);
- treatment and disposal of drill cuttings and wastewater from core drilling and foundation grouting operations;
- concrete operations;
- roads, camps, shops, and storage areas;
- asphalt operations; and
- herbicides and insecticides.

Structural impact of erosion on water areas.

Construction operations in water areas.

Land Pollution

Land despoilment by destruction of land forms and vegetation.

Environmental damage of the land by spillage and waste:
- concrete operation;
- asphalt operation;
- roads, camps, shops, and storage areas;
- rebound from gunite operations; and
- sandblasting.

A survey (Table 1) was accomplished to rank construction activities in their relative order of degradation of the environment.

Combining the factors of the survey into major groupings and estimating the *impact* of each on the environment is further depicted.

Rank Order of Construction Environmental Degradation

1. Clearing and grubbing
2. Runoff control
3. Borrowing
4. Access roads
5. Topsoil stripping
6. Hauling (excavation)
7. Drainage control
8. Concrete mix production
9. Felling trees
10. Demolition refuse disposal
11. Aggregate production
12. Curing concrete
13. Storm runoff
14. Bank protection
15. Stumping
16. Hauling (concrete construction)
17. Raw material delivery
18. Ground-water control (foundation)
19. Solid waste disposal
20. Channeling
21. Dumping
22. Concrete-cement
23. Ground-water control (excavation)
24. Asphalt plants.

Clearing and Excavation

It can be seen that over half of the environmental threat is attributable to the clearing and excavation phases of the construction (runoff, drainage and ground water control —20%, clearing and grubbing, felling trees; stumping—20%; and excavation—17%).

Many of the products in this phase of construction have customarily been burned at the site, resulting in harmful gases and particulate emission to the atmosphere. At the present time, specifications for federal contracts usually prohibit this practice. In most areas of the United States, this practice is not permitted or is severely restricted. Contractors are thus encouraged to dispose of such materials by other methods—usually at a landfill.

Erosion and the resulting sedimentation are both a water and land pollutant. During erosion, a large volume of earth moves, and is ultimately deposited elsewhere. Erosion most often occurs when the native vegetation is stripped, and replacement by construction or vegetation is not done quickly thereafter.

Highway construction is most often associated with erosion and sedimentation. The U.S. Geological Survey, the Pennsylvania Department of Transportation, and Department of Environmental Resources have recently evaluated different types of erosion control, in construction of I-81 near Harrisburg, Penn. The techniques used included the use of sediment ponds to catch the runoff; in one location, a dam was constructed on a river below the construction area, forming a large sediment basin.

The more conventional methods, such as prompt and frequent seeding, mulching, rock placement, and use of jute matting, were also used. (Jute matting, a biodegradable material, is rolled and secured over the soil until the vegetation roots stabilize the soil.)

The Ohio state department of transportation has identified delayed seeding and mulching of cut and fill slopes as the major deficiency in construction causing erosion. The department has directed enforcement of construction schedules and provisions for prompt seeding and mulching.

Demolition waste is another source of pollution encountered during the clearing and excavation phase of construction. Most often encountered are concrete, asphalt, timber and steel. Burning or burial have been the usual methods of disposal although timber has been recycled. In Iowa, the state highway department has been experimenting with a process in which old concrete is crushed, mixed with sand and gravel, and used as an aggregate base for concrete overlay. Not only is concrete waste reduced, but there is a potential saving of about 15% in new pavement cost. Such a procedure could become a very effective reuse of waste concrete.

Construction Waste

Materials in this category consist of paper and wood packaging materials, used wood forms (for concrete), scrap lumber, and other by-products of construction. Many of these items are not recyclable, and are disposed of in landfills. There is, however, a great recycling potential for metal waste products (fuel cans, damaged scaffolding,

(Continued next page)

construction environment

(Continued from preceeding page)

metal beverage containers) and other wastes (tires, plastic sheets, glass, etc.). An effort should be made to recycle these items, by including a recycling plan, and point of delivery to the county or municipality, in the contract specifications.

The Environmental Protection Agency has categorized solid wastes into categories according to their potential health hazard:

- **Type 1 Wastes:** Extremely hazardous, including explosives, flammables, corrosives, and toxic materials. Proper handling of these is mandatory in order to prevent damage to the health of humans and other living systems. Examples of hazardous wastes are radioactive plutonium and the insecticide Parathion.
- **Type 2 Wastes:** Moderately hazardous, including the hazardous wastes (Type 1) when they appear in small amounts, plus approximately 4,500 so-called moderately hazardous materials.
- **Type 3 Wastes:** Non-hazardous, when properly disposed of, these refer to materials appearing in community waste collection and disposal systems.

Obviously, construction waste can include all three types of materials. Depending upon the type of waste, disposal may include burial, recycling or burning. Burial and landfill are very popular methods; however, some possible harmful considerations are discussed later.

D. A. Spivey, in an article in the *ASCE's Journal of the Construction Division,* recommends that a solid waste management system be used in construction. In planning for disposal, he recommends a four-step procedure:

1. Evaluate the composition and estimate the volume of solid wastes that will be generated (including demolished structures).
2. Determine recycle potential (volume, markets, costs, return).
3. Evaluate disposal options available (recycle, burial, incineration).
4. Match disposal options to volume and composition of wastes considering economy, environmental protection, and resource depletion.

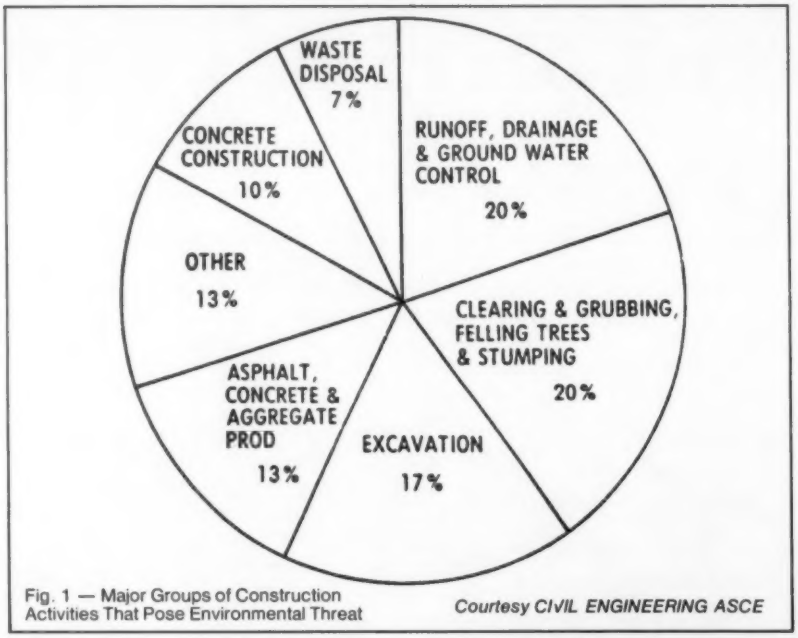

WASTE DISPOSAL 7%
RUNOFF, DRAINAGE & GROUND WATER CONTROL 20%
CONCRETE CONSTRUCTION 10%
OTHER 13%
CLEARING & GRUBBING, FELLING TREES & STUMPING 20%
ASPHALT, CONCRETE & AGGREGATE PROD 13%
EXCAVATION 17%

Fig. 1 — Major Groups of Construction Activities That Pose Environmental Threat

Courtesy CIVIL ENGINEERING ASCE

Noise and Vibration

The predominant cause of noise in construction is the construction equipment ranging from the largest earthmoving equipment, to backhoes, to pneumatic air hammers and wrenches. A problem of concern to contractors at this time is that there are no uniform noise standards for the industry.

While noise can be controlled by legislation, vibration is a more persistent problem, since it is a function of the amount of energy required to do a specific task. For example, one may demolish a building in a few seconds by the use of explosives, with a higher level of vibration, or by using a wrecking ball for an extended period. The vibration from the collapse of the building, when using explosives, is greater than the vibration from the detonation itself. The vibration of the collapse by explosion is of high intensity, but it occurs only once. The alternative would be thousands of impacts of the wrecking ball.

Another source of long-duration vibration is that of pile driving. Again, there are alternatives to be considered during the project design phase, such as drilled piles or caissons.

In such cases, the alternatives should be considered by the engineer during the preparation of specifications. It is not possible to have a blanket standard to apply to all construction. One must consider the proximity to the public, to other facilities, possible damage to those facilities, type of neighborhood (industrial, residential) and overall public relations. Such considerations are extremely important, because large cost differences in methods specified must be justified by the reduced environmental impact produced.

Source of Landfill

A rather unusual environmental problem is that posed by the source of landfill. The problem here is different from those previously discussed in that the effects from landfill used are lasting, as opposed to effects confined to the construction phase. Source of landfill is a construction concern, since rarely is the source of fill specified by the designer.

A recent problem discovered in Japan is that chromium-bearing wastes were used in landfill in factory, public housing, and school sites. Inhalation of chromium dust over a long period of time may cause lung cancer or cancer of the larynx, studies indicate. Chromium-bearing landfill has been used throughout the country, with most used in Tokyo.

This incident recalls the 1970 situation in the United States, when radioactivity was found in the sand used for construction purposes in Grand Junction, Colo. The problem was one of the first to be investigated by the ASCE's Committee on Social and Environmental Concerns. It was learned that radioactive sand from a closed uranium mine was used in masonry mortar, as well as for fill. Five-hundred schools and houses out of 5,500 examined had radiation levels exceeding federal standards. Both Congress and the state legislature appropriated funds to correct the situation. In most cases, the correction consisted of excavating beneath the structures and replacing the fill with uncontaminated sand.

Such corrective action is very costly, and the harm done to inhabitants in Japan and in Grand Junction, has not yet been fully assessed. The ASCE Committee has recommended that specifications prohibit use of radioactive or otherwise toxic materials in construction and construction products. Such provision would certainly help prevent recurrence of an incident such as the one in Colorado, although, in cases such as the chromium waste situation in Japan, the toxic threat of chromium in landfill was not known at the time the landfill was placed.

Dredging

A construction-related operation presently causing major concern, especially to the Corps of Engineers and the Naval Facilities Engineering Command, is that of dredging. Primarily, the concern is with the methods used to dispose of the dredged material. The Corps of Engineers has been expanding its jurisdiction over the discharge of environmentally harmful dredged or fill materials, in response to a federal court ruling. Up until recently, its jurisdiction was limited to navigable waters. The Corps' responsibility is outlined as follows:

1. The wetlands adjacent to the traditional navigable waters are under Corps control.

2. Effective July 1, 1976, Corps responsibility includes discharges of dredged or fill material into primary tributaries of navigable waters, natural lakes greater than 5 acres in surface area, and their adjacent wetlands.

3. On July 1, 1977, the authority will include discharges into other waters, generally up to the headwaters.

One of the reasons for the concern with "dredge spoil" is that since so many harbors and waterways are dangerously polluted, the "dredge spoil" itself would contribute to environmental pollution. Thus, in the past, designated disposal sites were used for dredged material. The Corps, however, has been considering uses for dredged material, consistent with environmental considerations, to turn the material into an asset rather than a liability.

Brigadier General Bachus, formerly the North Central Division Engineer (presently the Director of Facilities Engineering, Office of the Chief of Engineers), has proposed several examples of how dredged material has been used and can be used beneficially.

- Creating artificial marshlands or wetlands. This is popular among fish and wildlife advocates, and is sometimes used where adjacent wetlands have been lost to new construction projects.

- Creating artificial islands, for recreation, or public facilities. In Cleveland, Ohio, an area in Lake Erie adjacent to the city's shoreline is being built up for a close-proximity airport.

- Creating artificial beaches, and restoring beaches which have been eroded by wave and wind action.

- Creating boat launch or fish access sites.

- Using dredged material for structural protection. Dredged rock and hard material can be used as shore protection material, and to repair existing breakwaters.

- Using dredged material for landfills. There is seemingly always a demand for structural landfill, or fill for road beds, for which dredged material could be used.

General Bachus also suggests an evaluation, on a case-by-case basis, to determine the best possible use for a potentially valuable asset, dredged material.

Use of dredged material is not without problems. In addition to consideration of the environmental effect of placement (i.e., the type of pollutant, if any, in the material), dewatering of the material has been a problem. Dames and Moore (San Francisco) has developed a dewatering method for the Corps of Engineers in conjunction with their dredged material research program. Basically, the technique involves

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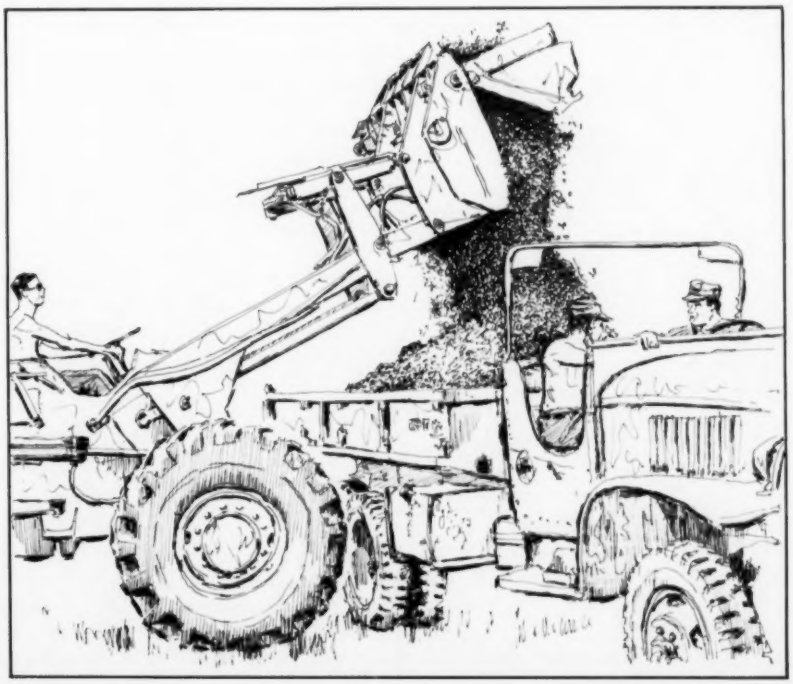


TWO SIDES of the TAX COIN

(Continued from page 6)

Department of Defense Instruction 4100.33 was then issued to implement these policies. It directed that scheduled periodic reviews be made, records be maintained and designated military departments as the approval authority for "new starts."

Commercial/industrial activities were originally grouped into 53 functional areas. The current instructions further divide these into 101 functional areas. These are coded and grouped into eight main areas: maintenance and/or repair of equipment (intermediate level); repair, maintenance, modification, alteration and/or rebuild of *non-mission-essential* equipment (depot level); repair, maintenance, modification, alteration and/or rebuild of *mission-essential* equipment (depot level); installation services; other non-manufacturing operations; automatic data processing; products manufactured/fabricated in-house; maintenance, repair, alteration and minor construction of real property.

The Department of the Navy in issuing its original instruction listed five policy positions:

1. The Navy stressed that it would operate commercial/industrial activities only in compliance with the five circumstances listed by BoB and DoD.

2. The Navy restated the department policy of not using this program as authority for methods of contract personnel procurement not authorized by law nor as a means of avoiding government personnel or salary limitations.

3. The Department of the Navy will continue to perform in-house those basic functions necessary to retain control over the conduct of its program.

4. Commercial/industrial activities are to be conducted with maximum cost effectiveness.

5. In specific situations, certain factors make it necessary or advisable for the Navy to produce goods or provide service for its own use. The Navy must indicate that there are reasons for such situations. These reasons must establish that government provision is in the public interest. This policy is now embodied in DoD Directive 4100.15.

In the years since publication of circular A-76, the Navy has converted numerous functions to contract operations. The Navy provides goods and services for itself only when it is clearly in the public interest to do so. Reasons for Navy in-house operation can be broken down into four major areas: military necessity; training and mobilization requirements; no other existing source; and less costly to produce. Two of the circumstances listed by DoD for the operation of commercial or industrial activities were combined by the Navy into one. "A satisfactory commercial source is not available . . ." and "The product or service is not available from another federal agency . . ."

Recent interest in reducing the size of government has brought renewed interest in circular A-76. The OMB has been especially interested in establishing the total cost to the government in both present and future costs and comparing this to a realistic contract cost. OMB has established factors to be applied against in-house costs to assess the value of such items as future costs to the government for fringe benefits; income taxes lost; cost of self insurance, etc.

The income tax lost is a percentage factor of the estimated contract cost that is added to the cost of in-house performance. This represents lost revenue to the federal government. If the contractor does not get the job, no income tax is realized on the payment he would have received. The federal government also buys no insurance. Like most large organizations they act as their own insurance company. The added cost is analogous to an insurance premium and represents a share of the federal government casualty losses.

To assure the most accurate comparison of in-house to contract costs the Navy implemented a firm bid offer procedure in December 1966. In those areas where the only justification for an in-house operation is one of least cost, the Navy activity submits a sealed bid and competes with the contractor for the work.

This procedure places a tremendous burden and responsibility on the Navy activity. The most obvious, of course, is assurance that the scope of work is accurately defined and that the in-house cost is as accurate. The activity must be certain that cost is the basis for in-house retention. This presupposes that there is a genuine and earnest desire on the part of the Navy to contract if the "price is right."

The problems of contractor competence and contractor "buying in" are always present. The Naval Facilities Engineering Command is meeting this problem by developing a contract that is "fixed price incentive with a firm target" (FPIF). This will permit the adding of several functions to attract larger contractors and permit smaller contractors the assurance of large enough contracts to justify larger capital investment. A major safeguard in this new approach is that they will be five year contracts — one year with four one year options. This will benefit both the government and the contractor and consequently the taxpayer.

It is important for the Navy to take a hard look at commercial/industrial activities to assure that we continue to do what we *must* and which we do *best* and to contract those things which are *best contracted.*

Naval Facilities Engineering Command

SITUATION REPORT

REAL PROPERTY UTILIZATION - Executive Order 11954 restates the requirement that all Federal agencies ensure full utilization of all Class I and II real property. The program involves both an internal annual review of holdings at the activity level and periodic surveys by the General Services Administration. With the completion of most AICUZ studies, the "AICUZ Hold" status has been removed from most Naval Air Stations, and those with completed studies should be prepared for a GSA survey in the near future. Nothing you do, or don't do, is more likely to draw adverse reaction from your boss, and his boss, than the loss of needed Navy real property through the failure to have the right justification and documentation prepared. To prepare for the GSA survey and the requirement for the annual utilization report, refer to OPNAVINST 11011.10B dated 26 July 1977, and make sure that the documentation is current. Any one of the 700 Navy and Marine Corps activities holding Class I and/or II property in its plant account is eligible for a survey on short notice.

(NAVFAC Code 09)

SEISMIC DESIGN MANUAL BEING REVISED - NAVFAC P-355, a tri-service design manual, is under revision by the responsible DoD agency - the Corps of Engineers. Suggestions or comments from the field should be submitted to NAVFAC Code 0452. The new manual should be published by the end of 1978. Navy activities in seismic zones 3 and 4 (see NAVFAC P-355 or consult EFD Design Division for zone locations) must continue efforts to identify and correct structures and utility systems with inadequate strength to withstand potential earthquake forces. A NAVFAC notice in the 11012 series has been issued with detailed information.

(NAVFAC Code 04)

GUIDANCE FOR METRICATION - The American Society for Testing and Materials (ASTM) is preparing a "Recommended Practice for the Use of Metric (SI) Units in Building Design and Construction." The draft has been reviewed by NAVFACHQ and the completed guide is expected to be approved by DoD. When published, it will be available to federal and military agencies without cost from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120. The new publication with the "ASTM E 380-76 Metric Practice Guide" and the "ANMC 75-1 Metric Editorial Guide" which are available from the same address, will serve as the basis for NAVFAC adoption of "SI" metric units.

(NAVFAC Code 04)

(Continued on page 36)

COMPUTER AIDED COST ESTIMATING (CACE) UNDER DEVELOPMENT - The Atlantic Division, in conjunction with NAVFACHQ, is progressing with further development of its prototype Computer Aided Cost Estimating System (CACE). The existing system has been effectively used at LANTDIV for final government estimates on over 100 projects from small rehab jobs to large new facilities. The system provides a computer storage area for pricing and descriptive information of building components. This provides a nucleus for many pricing application programs. The application currently being developed is for final government estimates. If the system operates efficiently at the detail level, it can then be expanded for use with preliminary design and budget applications. Implementation is planned for all EFDs following testing at LANTDIV.

(NAVFAC Code 04)

NEW DM-6, DRAWINGS, SPECIFICATIONS AND COST ESTIMATES - This design manual has recently been revised and when distributed, will supersede both DM-6, "Drawings and Specifications," January 1972, and P-74, "Drawings, Specifications and Cost Estimates Data for Preparation by A/E Contractors," March 1967. The manual contains policy information and guidance for the preparation of drawings, specifications and cost estimates for construction of the Naval Shore Establishment. It is also issued as an aid to Architect-Engineer contractors and will be available from the Naval Publications and Forms Center, Philadelphia, Penn.

(NAVFAC Code 04)

HERBICIDE ORANGE - THE END OF A SAGA - Military use of herbicide orange, a chemical defoliant which served as a jungle thinner during the Vietnam conflict, was banned by the Secretary of Defense in 1970. Subsequently, the Air Force Logistics Command was designated the responsible agent for disposal of the material, 850,000 gallons of which were stored at CBC Gulfport, Miss. Because of the herbicide's potential commercial value, several attempts were made to restructure the material into a marketable herbicide. A pilot plant was constructed at Gulfport in order to remove the herbicide's harmful contaminant, dioxin. Unfortunately, the operation yielded potentially toxic by-products. The decision was then made to obtain EPA approval to incinerate the herbicide in the open sea. The Dutch incinerator ship, Vulcanus, was contracted to burn the material. Incineration was accomplished in the Pacific Ocean in an area located approximately 1,200 miles west of Hawaii and was monitored by a California-based company under an EPA contract to record air and water emissions of the Vulcanus incinerator stacks.

(NAVFAC Code 06)

Boilers Healthy? Better Check Again!

By HARRY R. TAPLIN,
Mech. Engr., NESO

• Alexandria, Va.

A boiler can be on the verge of "death" and unless black smoke or internal rumbles accompany the throes, an observer can be totally unaware that something is amiss.

Surveys, in fact, have demonstrated that many Navy boilers are wasting more than $15,000 worth of fuel per year with no outward signs of dysfunction. Curiously, these units are noted "dependable" and everything looks great except the fuel bill, which is considered an expense to be tolerated.

The price of fossil fuels has risen more than 500% since early 1973; the oil embargo demonstrated that the oil pipeline could be turned off and natural gas supplies are rapidly running out. The hard fact that managers must recognize is that boiler fuel is a precious commodity that must be jealously conserved.

Fortunately, an inexpensive procedure is available that will lead to immediate fuel savings.

Flue gas analysis, if properly performed, is simple and yields accuracies within 1% of more expensive tests. The procedure involves measuring the amount of excess air (oxygen), carbon monoxide, carbon dioxide, a smoke index, and exit gas temperature. From this information, combustion efficiency can be determined as well as identification of some specific boiler problems.

If more oxygen is being supplied to the combustion zone than required for optimum performance, excess air is being heated and energy is being lost up the stack. In fact, the excess air keeps the plume from the stack ultra clear and is often allowed in the mistaken notion that less pollution is being emitted.

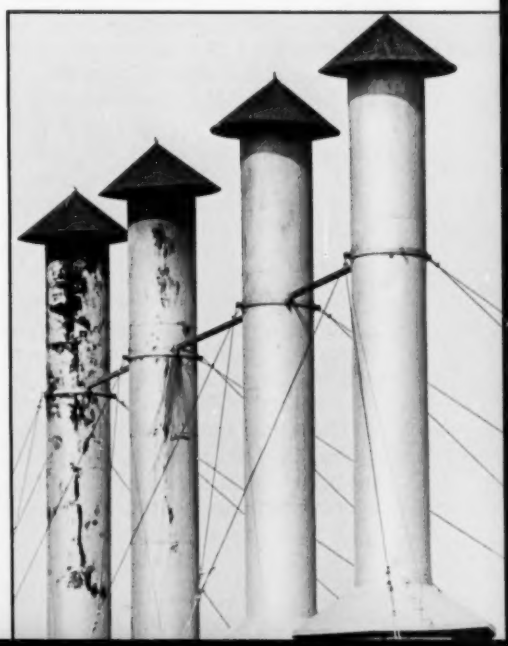
Very often a boiler's flame is chilled by the excess air and this allows fuel to go up the stack without any combustion. This and other problems in a boiler's combustion system make unburned fuel a major reason for inefficient operation. Such problems can be solved by adjustment or, in some instances, by replacement or rehabilitation of components; however, in any case, tuning must be rigorously monitored.

Just as too much air wastes fuel by needlessly heating the atmosphere, too little air causes soot buildup and creates an insulation that is more effective than asbestos. A soot coating of 3cm (1-1/8 inch) can reduce efficiency by as much as 10%.

Fortunately, flue gas analysis — both chemical and physical — can lead to the solution of many inefficient boiler operations. Furthermore, easy to use commercial kits, ranging in price from $250 to $1000, are available to assist in identification of problems. Although each kit is touted by its manufacturer as best, the Navy manager should look for the following measurement features:

- **Stack Thermometer.** A stack temperature higher than the boiler's manufacturer's recommended is indicative of one or more of the following deleterious conditions: (1) excessive draft; (2) defective combustion chamber; (3) soot-coated heating surfaces; (4) improperly adjusted or incorrect draft regulators.
- **CO_2 Indicator.** A low CO_2 reading, with an attendant increase in CO indicates that fuel has not been completely consumed. Low CO_2 and high O_2 indicates high excess air. Each boiler is different, but normal CO_2 readings should range from 1% to 6%; CO_2, which varies with the type of fuel, can range from 8% to 11% with natural gas and from 10% to 15½% with oil.
- **Smoke Tester.** A device to compare particulate collected on a filter to a standard "smoke pot" chart. The higher the concentration (smoke spot number), the greater the emissions and fuel consumption. This provides data about sooting on the heating surfaces.
- **Draft Gauge.** The draft, usually measured in inches of water, governs the amount of air supplied for combustion. Too much air will produce a clean stack but will waste fuel at an enormous rate; too little air will produce soot and will lower boiler efficiency.
- **Flame Appearance.** In addition, viewing the flame area can be used as a preliminary indicator of combustion conditions. Because of variations caused by different fuels and combustion equipment design, a "good" flame is hard to generalize; however, it should not impinge on the furnace wall or contain small sparklers or dark streaks. A symetrical, lazy-rolling flame is typical in a well tuned oil-fired boiler.

Perhaps more important; it is necessary to fine-tune the equipment using accurate flue gas readings on a day-to-day basis as indicated by operating conditions, fuel chemistry, and the tendency of settings to change due to vibrations and other causes.



Stacks — What goes up a smoke stack is a big clue to the health of boilers. Too much air produces a very clean exhaust — and a waste of money as fuel is used to heat excess air. Too little air will produce a coating of soot on boilers. Soot is a better insulator than asbestos!

CESO And Standardization

By REGINALD V. TUNSTALL
Materials Engineer, CESO

• Port Hueneme, Calif.

When you spend $400 million a year for equipment and materials for your command — and help other naval procurement activities spend $60 to $100 million, what you buy had better be described accurately, and all the technical requirements of the items, services, or materials must be determined in advance with absolutely no ambiguity!

How do you do this? You write a quality specification that describes what you want and how it shall perform; include procedures to determine that it meets required quality, method of inspection and test, method of packaging; and ordering — procurement criteria.

NAVFAC's Civil Engineer Support Office at NCBC Port Hueneme, Calif., is charged with providing certain equipment and material globally. CESO also supports readiness by managing the Advanced Base Functional Component System and Prepositioned War Reserve Materiel Program.

NAVFAC has assigned CESO responsibility for management of the Navy's construction, automotive, and specialized equipment for these programs, including determining requirements, budgeting, engineering, maintenance, repair parts support, and readiness planning for over 100,000 pieces of equipment valued at nearly $1 billion. CESO also has responsibility for the "Management Information System" covering Construction Battalion Center, Civil Engineer Support, and the previously mentioned Construction, Automotive & Special Equipment.

For each of these management programs, CESO provides field coordination including preparation of pertinent chapters of the Navy Facilities Systems Manual; establishment of priorities; systems design/development including data analysis, logic, information displays, testing, and documentation; and serves as management representative or working proponent for systems users (problems encountered by users, or changes required, are sent to CESO for coordination and resolution).

The three Management Information Systems are each divided into sub-systems, each of which covers a major area of CBC operations and, in some cases, impacts other commands. The Public Works Department subsystem will handle utilities, housing, and transportation. The Construction Equipment Department subsystem supports the three CEDs and their $8 million in annual business, provides production control, scheduling, material status and quality control. The supply sub-system provides inventory control and technical information on 100,000 National Stock Numbers used by the three CBCs. It assists processing requisitions and handling component shipments.

The Civil Engineer Support MIS directly supports the Naval Construction Force and its ability to mobilize by maintaining a detailed listing of NAVFAC's and NAVSUP's contribution to the ABFC system and the Table of Allowances for more than forty NCF and special operating units.

CESO can provide management studies in areas such as organization, military personnel and logistics, and can perform operational research analysis. Inherent in the Management Information Systems and our other tasks, is writing and distributing about twenty NAVFAC publications, including Construction Equipment Time Standards (P-280), NCF Equipment Management Manual (P-404), Facilities Planning Guide (P-437), Planning & Estimating Handbook (P-405), Construction Methods Manual (P-440), CED Operations & Management Manual (P-434), and PW Specifications (P-34).

Additionally, Standardization Department prepares some 900 specification documents for items and materials used by the Navy, reviews 2,000 specs for NAVFAC's unique requirements, monitors 1,500 more for NAVFAC interest, and provides an access point to over 40,000 Military/Federal documents in the DoD system. Standardization as a part of CESO, manages assigned federal classes of items and materials and reviews and coordinates input of all naval commands for about 100 classes of material. Terms such as "standardization" and "federal classes" tend to be dry and not very descriptive, so let us take a look at what Standardization's job is and what they really do!

First they write and prepare material and equipment specifications and standards for the Navy. They not only review, revise, update, cancel, and coordinate their actions regarding military specs and standards but are also involved with federal specs and standards — those documents generated by federal agencies outside the DoD. Also, they coordinate with industry groups who generate specifications and standards.

What, exactly, is a specification or a standard, and what impact might it have on a Resident Officer in Charge of Construction at a field activity, a Public Works Department, or an Engineering Field Division? When the document is written it should contain all the technical, design criteria, quality assurance, testing, packaging, shipping, ordering and procurement data to assure the using agency it will purchase an item of known characteristics and cost.

Having once set down all the verbiage to ensure this, it is necessary to coordinate the embryo specification with every conceivable governmental user and every possible supplier — manufacturer so all agree the document reflects requirements that can be met without high cost, yet are state-of-the-art. Once all agree, the specification or standard can be approved, printed and issued.

It is then listed in the DoD Index of Specifications & Standards (DoDISS) and other document index media and put to work! Field activities can reference the spec or standard in procurement or contractual

documents knowing the item or material described is available, will meet design and performance criteria, be of acceptable quality, and provide nation-wide commonality. Field activities are urged to contact CESO Standardization for help in solving problems.

At least every five years, documents are reviewed and, if they are still useable, they are revalidated. If state-of-the-art has changed or user requirements have changed affecting design, construction, quality assurance, test, packaging, etc; the document is revised and again coordinated for comments before re-issue. On the other hand, if the item or material has not been used for some time or will not be needed in the foreseeable future, the spec or standard will be cancelled.

There are other specifications and design criteria of use to field activities, usually listed in manuals such as the P-34, for example. In this document you find TS (Type Spec) series guide specifications for use in all military construction, from site work to finishing and furnishing. Also listed are Type Specifications for use in contract maintenance projects, federal construction guide specs, DoD guide specs for military family housing, the applicable Military and Federal Specifications referenced in the Type Specs special specifications and standards (usually documents generated by other agencies within the government) and, finally, non-government specifications generated by industry associations.

Standardization is interesting form a historical point. DoD interest stems from early efforts of the Army Quartermaster Corps to involve a large number of automotive manufacturers in standardizing. The military bought 316 differing makes and models of vehicle during WW1, which required 445,000 repair and replacement parts. The imminent collapse of all motor transport was averted only by the signing of the armistice.

By WW2 a measure of relief appeared. Wide use of common parts and standard fittings existed, yet little had been done to the supply catalog. Repair parts were listed under Navy part number, Army part number, Drawing number, Manufacturers part number, et al. After WW2, emphasis was put on use of "standard" and interchangeable components. The Defense Standardization Program (Secs 2451-2456, Title 10, United States Code, codifying Public Law 436, 82nd Congress), requires the highest practicable degree of item standardization and practices applicable throughout the DoD, and is implemented by DoD directive 4120.3 and Standardization Manual 4120.3-M.

Standardization must keep up with technology, yet rely on commercial standards and practices as much as possible. After all, production means tooling and tooling means big money. Standardization today extends overseas and items now are cataloged by NATO Stock Number with ready reference to item description, a manufacturer's identifying code number, federal stock classification number, specification number, supply source, unit price, quantity pack, size and weight, shelf life, and information on who normally uses the item! The NATO stock number allows standardization between nations, thus preventing duplication of effort.

Aiding specification preparation are the following:

• Program Analysis — Evaluation reports are prepared to define the feasibility and desirability of standardization for direct support of procurement functions, support of engineering design-development, support of supply management, and support of other related activities.

• Five Year Defense Standardization Program — This is a result of recommendations and objectives set by program analysis. Controls are established to insure the progress of standardization projects so specifications are maintained "up to date."

• Engineering Support Activity — Responsible project engineers furnish technical support to other government agencies and activities for items management coded to them. When these activities feel a procurement document is inadequate, or a proposed substitute may be better, they ask engineering support. This will consist of technical assistance, including the data development, guidance in decisions required, and evaluations of requests for deviation, waiver, alternate bids, and similar proposals to support effective and competitive procurement.

• Item Reduction Studies — These studies are made when there are many similar items in the supply system. These items may lend themselves to grouping by size, grade, length, material, etc. The goal is definition of those items to be retained for stock and costs reduction.

• Federal Item Identification Guides — The guides provide criteria for determining whether items are identical and possible substitution of items through a characteristics screening. Standardization activites are responsible for reviewing technical data range criteria, that is, they compare parameters and tolerances to military and industry standards.

• Preservation and Packaging — Application or use of measures to prevent deterioration of items includes cleaning procedures, preservation and protective wrappings, cushioning against shock, interior containers, and complete identification markings. Objectives are to provide efficient protection of supplies and equipment from all damage, to assure maximum life, utility, and performance. Uniformity is obtained in the preservation and packaging of same or similar items and economy of methods, by assuring use of packages of minimum weight and cube, consistent with anticipated storage and shipment hazards.

Analysis of the frequency and dollar value of procurement and mission requirements contributes to setting priorities for retention, revision, or development of specifications or standards.

• Data Management — As technology and hardware systems grow in complexity, the need for support data has gained importance. Here at Port Hueneme, the NAVFAC field data management office (FDMO) is a part of standardization. The FDMO is responsible for taking part in planning and policy formulation, technical manual management, cost reduction reporting, data storage and retrieval systems, and providing guidance and assistance to other NAVFAC elements.

Standardization is staffed by thirty-eight people responsible for timely completion of the tasks indicated above. Any way you look at it, that's quite a slice of the responsibility pie!!!

Surviving As A Staff Corps Officer

By LT J. E. SPENCER, CEC, USN
EIT, Ind.

• Sasebo, Japan

Bartenders and marriage counselors alike may tell you one of the most common complaints aired by their male clients is, "My wife just doesn't understand me.

Similarly, I've heard many CEC, as well as other staff officers, lament, "My (line) commanding officer just doesn't understand my problems!" To be sure, a junior officer with less than 10 years experience in a staff position subordinate to a commander or captain who can say he joined the Navy before the staff officer was born, faces a great challenge. Perhaps the following observations by a junior officer 'in the trenches' will prove useful to compatriots who wage the daily battle of persuading "the boss" to accept their recommendations.

An officer in a staff capacity is usually advising his boss on the allocation of scarce resources — i.e. funds, personpower, equipment, and so on — to particular programs under the staff officer's cognizance. With few exceptions competition is keen in the staff arena. The major players may include the facilities officer, the comptroller, supply officer, operations officer, repair officer and others.

Obviously a staff officer's goal is to maximize his effectiveness which is reflected by the extent his recommendations are adopted vis-a-vis those of his competitors.

An important factor influencing the acceptance of one's recommendations is the manner in which they are presented. Usually, assume that the boss knows little about your subject, after all, being the expert is *your* job. Make your ideas difficult to reject by logically presenting all pertinent background information, considering all reasonable alternatives and stating the rationale leading to your proposal. When in doubt, opt for providing too much information rather than too little; however, conciseness and relevancy are virtues not to be taken lightly.

Even if your boss happens to know your subject as well as, or better than you, a detailed review of the facts, alternatives and rationale will confirm your own familiarity with the subject and the thoroughness of your staff work.

In my experience, the degree of effectiveness an officer achieves can often be greatly influenced by the esteem (or lack thereof) in which he holds his boss. Officers in the rank of commander and captain normally have a great deal of experience managing people. They are therefore quick to sense those who hold them in disdain — even when well-guarded — and can hardly be expected to cast a favorable eye on the proposals of such subordinates.

The fact is that few officers achieve highly responsible positions without considerable previous management success. The best policy is to assume your boss made it to his position based on his own abilities, regardless of your personal reservations. Now, his sense of priorities may vastly differ from yours and I'll address this issue in a moment.

Another remarkable behavioral factor is an officer's ability to bounce back from adversity. One cannot realistically expect to win every conflict in competitive staff dealings. When setbacks do come, an officer's ability to bounce back and tackle the next problem with vigor and enthusiasm is important to success.

I believe a staff officer cannot discharge his duties effectively without his boss's confidence in his capabilities. Such confidence is extremely delicate; can usually come to fruition only through careful, patient nurturing; and is easily withered by two common mistakes. First, never guess at the answer to a question and represent that guess for factual knowledge. You will find such guesses to be often in error, correction of which will prove increasingly embarrassing. If the answer to a question is not immediately known to you, admit it and pursue the correct response as soon as possible. The risk of seeming uninformed about job related matters is small compared to the loss of credibility with your boss that is sure to follow an unlucky streak of several inaccurate guesses.

The second confidence-eroding mistake is continual, persistant, and vocal opposition to the boss's position on program issues. To some extent conflicts are natural and healthy; however a staff officer must be sensitive to the amount of conflict beyond which his performance is degraded. He must decide which issues to pursue; which to abandon. Efficacy is very often enhanced by meeting the boss's desires on minor matters and concentrating your efforts on subjects of significant consequence.

The best policy is to assume your (line) boss made it . . . based on . . . ability, regardless of your personal reservations.

If your boss's sense of priorities differs greatly from yours, the two of you are bound to share opposite points of view on many, if indeed not most, program issues. In such a situation maintaining a sense of perspective is important, as well as accepting the fact that the boss is ultimately responsible for his own management decisions and the performance of his subordinate organization. If your boss's notions are customarily adverse to your own, it is doubly important to make the initial presentation of your subject so persuasive toward your point of view, by shear force of logic, that any other conclusion tends to absurdity.

As I see it then, success on the staff boils down to some pretty basic factors; a logical presentation of thorough staff work; treating your boss with genuine respect; maintaining a positive attitude; and recognizing boundaries to your area of responsibility.

Following such basic principles, though, often proves as difficult as getting orders to your first choice of duty.

Landfill Prevents Riverside Subsidence From Endangering Academy's Nimitz Hall

By ARTHUR H. WU,
P.E., Md.
Soil Mechanics and Foundation Specialist
Chesapeake Division
• Washington, D.C.

The U.S. Naval Academy is engaged in modernizing and expanding its educational facilities which has to date included construction of the multimillion dollar Nimitz Library and Rickover Hall. *(See Navy Civil Engineer,* Summer 1972).

To support the Nimitz Library a landfill of about 1.4 hectares (3.5 acres) was constructed along the Dorsey Creek in 1970. The Nimitz Library is founded on cast-in-place concrete pipe piles which are partially embedded in the landfill.

Before the filling, the elevation of the area ranged from —.9144m to —6.096m (—3 to —20 ft.). Soil borings showed a deep layer of soft organic clay averaging about 16.764m (55 ft.) thick underlying the fill site. Analysis indicated that this clay soil, which has low shear strength and high compressibility characteristics, would not safely sustain the weight of ordinary fill necessary to raise the grade to about +1.524m (+5 ft.). The measured shear strength of the clay was 6.9—16.1 kgm^2(150—350 psf).

To complete the expansion on schedule, the landfill was lightweight oyster shell to lessen instability of the embankment and to reduce settlement. Vertical sand drains were then installed to accelerate consolidation of the underlying clay material. The landfill was completed in September 1971.

Later, the fill surface showed large and rapid subsidence. The rate of subsidence was far greater than the settlement anticipated from consolidation of the soft clay soil. A careful inspection of the Nimitz Library structure revealed cracks in some of the pile caps and girders. The landfill movements were then monitored by fifteen settlement platforms and nine slope indicators which were installed in the fill area.

Subsequent investigation of the problem revealed that excessive fill movements were aggravated by overloading of the upland area during construction of Nimitz Library and Rickover hall. The lateral movement appeared to have caused additional earth pressure to the piles embedded in the fill area, thus presenting a potentiality of structural damage to the library building. The large settlement which occurred in the landfill made the area non-usable.

As an emergency solution, about .6096m to .9144m (2 to 3 ft.) of upland fill was removed in March 1974 to prevent general slide of the landfill embankment. After removal of the fill, the vertical settlement declined from about 3.18cm (1.25 in.) a month to .64cm (0.25 in.) a month, while the maximum lateral displacement slowed from about .762cm/month to .254cm/month (0.30 in/month to 0.10 in/month). The rate of movement, however, remained the same through 1975.

Lowering the fill grade resulted in the area being flooded whenever a high tide in the creek occurred, and vehicle access was lost. However, without first improving the stability of the entire landfill, it could not be restored to its original level.

In February, 1976, remedial work on the landfill stability took place. The stabilization methods included application of several techniques:

• A counterweight was applied at the toe of the fill slope and the slope was flattened to confine the entire fill area. A stone berm was constructed in the creek and restored the slope to 1:10. Stability of the landfill, in terms of safety against sliding, will increase about 70%, according to idealized slope stability analysis.

• A pile supported bridge was built to convey traffic around the most critical area, and a pile supported seawall was constructed at the perimeter of the landfill. Stability of the landfill will increase about 120% from traffic loads and the embankment weight to a compact sand layer at deep elevation.

• The weight on the upland was reduced by removing the heavyweight fill from the area and replacement with

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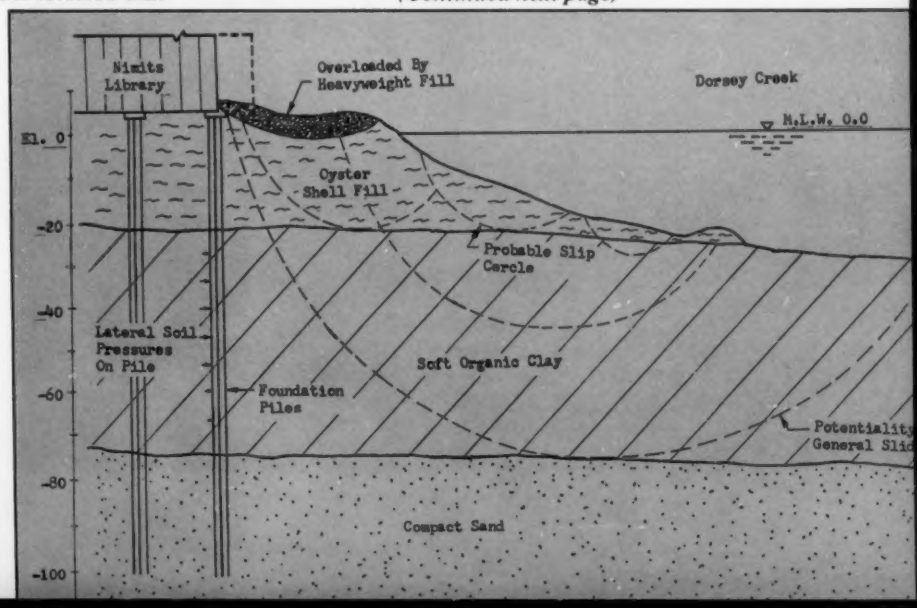


Hazard — Heavy fill used during the early 1970s was causing subsidence along the banks of Dorsey Creek at the Naval Academy and threatened several new buildings.

lightweight slag fill. Stability of the landfill increased about 110%.

The soil stability analysis was made at the most critical section. It was estimated that after the remedial work, up to .9144m (3 ft.) of settlement is expected to occur in the fill during 30 years. Therefore, the parking areas and roadway on grade were designed to accommodate the expected settlement problem by using flexible unit block pavers. It will permit differential settlement, provide effective surface drainage, and will be aesthetic in appearance. Surface drainage was accomplished by a grid of dry well catch basins. The remedial work provided an adequate factor of safety against dangerous lateral movement of the fill. This has been verified by monitoring of movements which were made continuously during the construction.

Other features of this project included application of a precisely controlled construction sequence and monitoring system to minimize disturbance of the landfill and to observe fill movements during construction. The sequences of construction specified and implemented were:

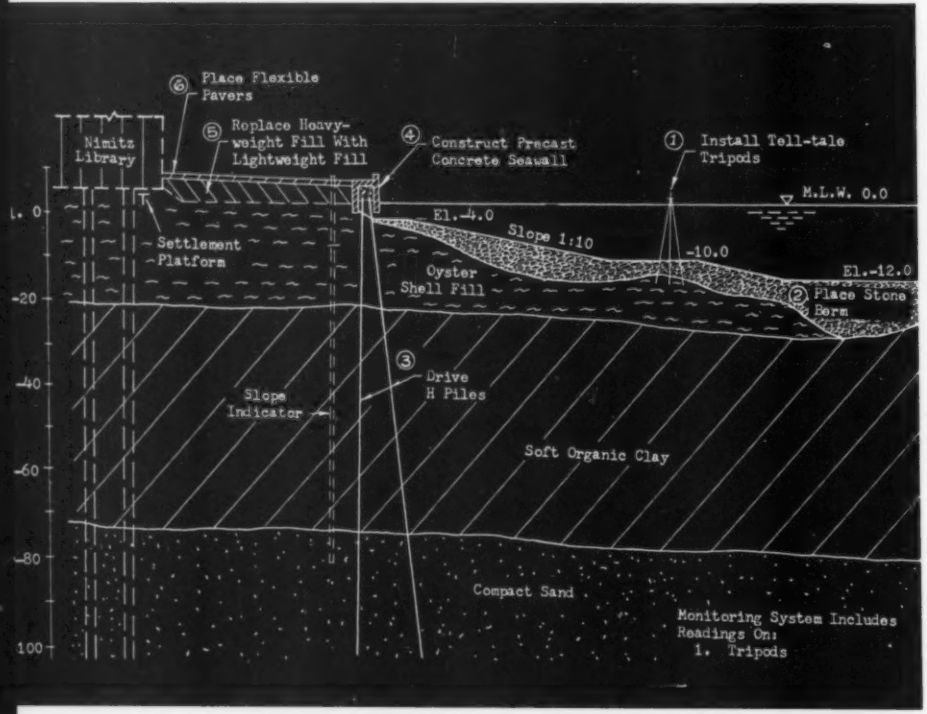
- Install fifteen tell-tale tripods in Dorsey Creek to monitor and avoid a mud wave during stone berm filling.
- Place stone berm at the toe and on the slope of the embankment evenly.
- Drive H piles for seawall and bridge support according to a specified order.
- Construct pile caps, seawall and bridge.
- Replace heavyweight fill on the upland area with lightweight slag.
- Place flexible pavers and dry wells for drainage on the parking areas.

The monitoring system has included taking continuous readings on the tripods in the creek, observation points on the library building, settlement platforms on the fill, and slope indicators in the fill. The grades of stone berm placed under the water were checked by sounding periodically during and after the stone filling.

The main landfill stabilization work was essentially complete in March 1977.

The stabilization method used in this project has, so far, proven successful. The progressive lateral movement of the fill toward the creek has been arrested. The danger of such movement, which occurred particularly to the library building, has been eliminated. The landfill area has been restored as a fire vehicle access route and as an aesthetically pleasant site conforming to the surroundings of the Naval Academy environment. Many new control monuments have been established on the upland and under the water. The monitoring work on these control monuments, and on the in-place slope indicators will continue for at least 2 years to observe future movements of the landfill.

Designs of the intial landfill project and also the remedial work were made by URS/Madigan-Praeger, Inc. of New York City. The A&E firm presented this landfill stabilization design as its project entry in the competition for the New York Association of Consulting Engineers' Engineering Excellence Award and won the first prize for design services in April 1977. Philip Brown, NAVFAC soils consultant, and Dr. Gregory Tschebotarioff, consulting engineer of New Jersey provided technical consultation on this project. The resident officer in charge of construction at the U.S. Naval Academy supervised the construction work.



Solution — To counter subsidence, the heavy fill was removed and replaced with lightweight slag. Piles, supports, and berms were also used to halt the migration of land into Dorsey Creek.

Getting Gear Ready For A Cold Winter

By CHRISTOPHER LEPPEK, JO2, USN

It's taken for granted that when a mother sends her child out into the cold winter weather, she makes sure the child is kept warm and protected from the cold temperatures and snow. It isn't only people, however, that need protection from the cold; machines do, too. An example is the huge construction equipment inventory bound for Operation Deep Freeze at McMurdo Sound, Antarctica.

To assure that these heavy vehicles remain functional in the frigid climate near the South Pole, the Construction Equipment Department (C.E.D.) at the Construction Battalion Center, Port Hueneme, Calif., has the duty of overhauling and preparing six pieces of equipment. The equipment, four 4,545kg (5-ton) dump trucks, one 4,545kg (5-ton) cargo truck and one 4,545kg (5-ton) tractor would never last if they were sent down to "the ice" with no special preparations. At times, it gets to -90°C (-50°F) at that location and the average temperature is a sultry -23°C (-13°F).

The employees of the department have had the responsibility of "winterizing" these vehicles since early spring when they were sent back from the Antarctic for major overhauls.

In addition to winterizing the gear, they were stripped down to the frame and overhauled. New brakes, transmissions and nearly everything else that wears out were replaced with new parts. The tires had to be replaced or repaired. They are large "flotation" aircraft-type tires specially designed to keep the equipment on top of the snow instead of under it.

The usual olive-drab color was covered with a bright orange-red, virtually the only color visible during Antarctica's notorious whiteouts of zero visibility. For driver comfort, special arctic heaters were installed in the cab along with special insulation.

In such temperatures, regular oils and greases would gum up to such an extent that the engine would never turn. Special greases and oils for the arctic are used, such as lubricants with a density of 5-weight.

The project will cost an approximate $85,000 to complete, and it demanded the varied skills of many of C.E.D.'s 150 workers, a versatile group of tradespeople.

Outside such assignments for other commands, the department's primary mission on the Center is to maintain the pre-war stock of equipment kept ready for contingencies. The department also does major overhaul work on Naval Construction Force equipment and NCTC training gear and does some work for the Public Works Department and the 31st NCR. With their large spectrum of mechanical skills, there are many kinds of jobs the tradespeople can handle, and they often get work from other commands who cannot do it.

Family Housing Responsibility Adjusted

By JON MOORE AND JOHN KNUEVEN

• Alexandria, Va.

Over the past several years, the complexity of the Navy's housing program has increased considerably. Trends show increased emphasis on operation and maintenance of government-owned units. Special emphasis is placed on identification of all maintenance and repair deficiencies, as well as major repair projects to reduce deficiencies. Also, attention is focused on reducing annual O & M costs by reviewing the need for keeping older quarters and by improved facilities management through standardization of housing staffing, organization and by setting up uniform operating procedures at the activity level.

This new emphasis has led to a review of the NAVFAC family housing organization. The conclusion reached through this review was that support to both field activities and higher management levels can be improved.

Under the adjustments, EFD commanders — commanding officers will be responsible for the housing program, including day-to-day funds management for all activities within their area. Each activity will get all housing assistance from one EFD rather than two or more as was the case. The geographic EFD will provide funding, budgeting assistance, development and execution of repair, improvement and new construction projects, family/bachelor housing survey assistance, housing referral and occupancy assistance.

The EFDs now supporting major claimants and commandants will continue to provide support for facilities planning, budgeting and staffing in family housing matters and will assist with family housing programs and issues at subordinate commands.

Realignment started Oct. 1, 1977, and will be accomplished in phases, with completion planned by the end of FY78. The phased action is scheduled for the entire fiscal year to ensure uninterrupted service to all activities while, at the same time, turning over management responsibilities to the EFD as quickly as possible.

Advanced Ocean Construction Techniques Smooth Navy Combat Pilot Training

• Washington, D.C.

In August, 1977, Navy ocean engineers worked with private contractors to install four ocean towers 48km (30 miles) offshore Kitty Hawk, N.C., in 30m (100 feet) of water. The towers, which support the East Coast's Air Combat Maneuvering Range, are three-legged, jacket-type structures fixed by pilings driven through the ocean floor.

The steel superstructure is designed to survive wind and wave forces and has triangular-shaped upper and lower decks. The decks are supported by 23m (75-foot) vertical, hollow, tubular columns and are high enough to remain above the crest of storm waves. Attached to the three columns at the water's surface are a boat landing, walkways, and stairways leading to the decks above. The tower's 30m (100-foot) jacket, which rests on the seabed and extends to just above the water's surface, also has three, equilaterally-spaced steel legs.

These legs are also hollow and tubular, but slope outward instead of vertically. The jacket legs are laced together with braces to withstand the vertical and lateral loads which the tower may encounter during its 20-year design life. Each jacket leg is pinned to the ocean floor with steel pilings driven 76m (250 feet) into the continental shelf.

Air Combat Maneuvering Range instrumentation is located on the top deck of the superstructure. This air range is a new, safe, and cost-effective way to train naval pilots.

The only instrumentation to leave the ground is housed in a low-drag, missile-shaped pod mounted on the aircraft just before a training exercise. In the air, the pilot arms and triggers his weapon system, just as he would in combat. But, instead of a live firing, his missiles are electronically simulated. Electronic data is transmitted through instrumented towers which operate unattended on solar power to high-speed, shore-based computers.

The computers process data from the aircraft pod and the towers, and compute aircraft positions and altitudes, interaircraft values, safety conditions, and hit or miss results. Whatever the pilot sees out of his windscreen, the computers reconstruct for the ground instructor. The instructor, no longer in the "back seat" with restricted visibility, is on the ground where he has real-time access to all events.

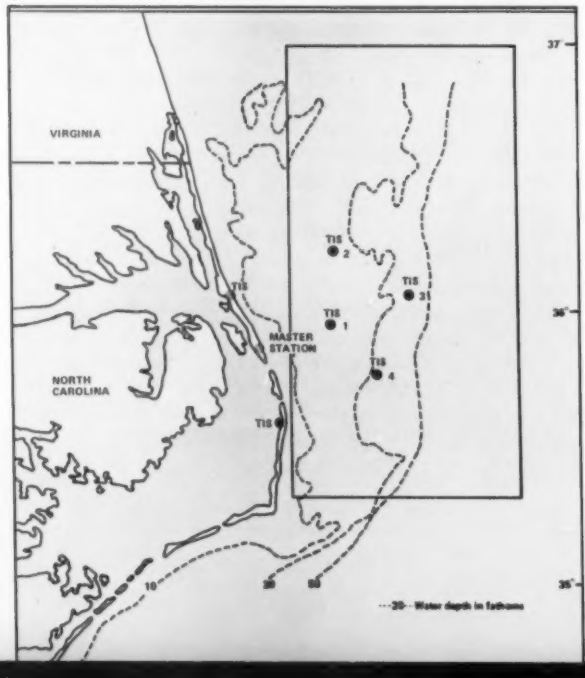
He can tell the pilot at once if his shot is a hit or miss and why, via two-way radio link. The Air Combat Maneuvering Range is the closest possible approach to actual combat without firing live weapons. The system can track and monitor up to 20 aircraft over a 4,100km^2 (1,600 square-mile) range. This unique capability is possible through strategically positioned instrumentation towers.

The four towers offshore Kitty Hawk are equidistant from one another, forming an approximate diamond shape. Combined with the three additional instrumentation packages on land-based towers along the outer banks of North Carolina, the range encompasses an approximate 48km (30-mile) circle capable of tracking aircraft from 15.2 to 18,200m (50 to 60,000 feet) in the air.

Tower design was a team effort by CHESDIV ocean construction engineers, Crest Engineering, and by TERA, Inc.

Weather and soil conditions were analyzed to determine design parameters, predict design loads, and the corrosion and bottom scour effects of wind, wave, current, and temperature. Weather proved a particular problem because of the Cape Hatteras site. As one author has noted, "No East Coast area is as treacherous as that found off the shores of the outer banks."

This meant the towers had to be installed between June and August. Basically, the engineer-designers had to design ocean structures to withstand 19m (62-foot) waves, two to four knot currents, 225kph (140 mph) winds, and temperature which



Spotted — Locations of the four training towers which will allow near-real simulation of air-combat training. Instructors remain ashore and get real-time readouts of all important events during the mock combat. All combat is realistic, but involves no costly live missile firing.

ranged from 0-39°C (freezing to 100 degrees), with a design life of 20 years. The designers chose the tripod-type structure as most economical and best able to withstand these severe design criteria. This structure has a low weight compared with the typical off-shore drilling platform and allows for complete control of the installation with a derrick crane. The proposed installation operation was to overboard the jacket; orient and locate the jacket by a controlled flooding of its legs; drive the pilings through the jacket legs to a nominal 76m (250 feet); place and secure the superstructure on top of the pilings; and affix the instrumentation package.

In January, 1977, a contract was awarded to Brown and Root Marine Operators, Inc., for the fabrication, transportation, and installation of the four towers. Fabrication began soon after at Brown and Root's Green Bayou facility in Houston, Texas. Using over 273,000kg (3,000 tons) of steel plate, workmen at the fabrication site burned, rolled, and welded the plate into 1.8m (6-foot) long cylinders or "cans" which varied in diameter from .84m (33 inches) for the superstructure, to 1.06m (42 inches) for the pilings, to 1.2m (48 inches) for the jacket. The steel cans were welded together to form the necessary lengths of structural columns, legs, braces, and pilings. Lying on its side at the site, the parts of the structure were then welded together to form the jacket and superstructure.

To move the towers from the Houston Ship Channel to Kitty Hawk, a 2,700km (1,700 mile) trip, 32,000kg (350-ton) mobile cranes were used to load the superstructures, jackets, and piling on the cargo barges. Accompanied by tugs, two of the towers were transported to the site — marked earlier with buoys — while the remaining two were being built.

Once at Kitty Hawk, the 32,000kg (350-ton) capacity derrick barge, the *H.A. Lindsay*, was positioned in a four-point anchor moor over the construction site. The cargo barge carrying the jackets arrived alongside the derrick barge. With tugs to minimize the impact forces between the two barges, the crane from the *Lindsay* swung over and attached itself to the jacket. The jacket weighed 18,200kg (200 tons) the heaviest lift in the operation. Raising the jacket free of the barge, the crane lowered it into the water until the jacket floated just above the water's surface. Riggers in life jackets switched the rigging so the jacket could be righted.

With the jacket on the sea bottom, the crane swung over and grasped the first 27.3m (90-foot) length of piling, lowering it into one leg of the jacket. This operation was repeated until all three legs had pilings inserted in them. With a 040 hammer that weighed 62,000kg (70 tons), each piling was forced downward into the seabed.

When the piling was driven into the jacket, the crane picked up additional lengths of piling and aligned them on top of the inserted piling. Welders bonded the two lengths together, and diving resumed. This time, however, a 560 steam hammer that weighed 124,000kg (140 tons) and was the size of a boxcar was used. This operation was repeated until the piling for each jacket leg was driven down 76m (250 feet). The pilings were then welded to the top of the jacket leg and cut off at their proper elevation to receive the superstructure.

When the jacket was in place, the crane lifted the 68,000kg (75-ton) superstructure from the barge and fitted the stabbing cones of the superstructure onto the tops of the three pilings. This was a delicate operation, equivalent to threading three needles at the same time.

Next, boat landings and walkways were welded on at their proper elevation. The instrumentation was then affixed — solar screen, navigational lights, fog horn, and electronic package.

Divers from UTC One inspected each underwater weld to insure that the quality of workmanship and safety of the tower were sound. They also obtained baseline data of bottom conditions and anodes so future underwater surveys could record accurate bottom scour and the effectiveness of the cathodic protection system.

Because of instrumented Air Combat Maneuvering Ranges such as this one, pilots can fly against thinking pilots, against each other, instead of drones or tow targets. Aircraft can now be pitted against aircraft in realistic air combat maneuvering minus only the live missile launches. With the support of this system, pilot proficiency is expected to double, a visible example of the Navy's ability to use ocean construction engineering to enhance Fleet readiness and national defense.

Completed — One of the four towers which will support air combat training is shown here. The triangular-shaped, tripod-legged towers are solar powered, automatic, and highly cost effective.

AVF

(Continued from page 26)

turmoil that would be created if there was a draft."

Americans have every right to be concerned about defense costs. But the current attack upon military manpower costs — coupled with a call to return to the draft — seems more than coincidence as many of the orchestrators now busily engaged in discrediting the AVF are the same who led the fight against its advent. At that time they extravagantly predicted its failure and now that their dire predictions have failed to materialize, they seem determined to destroy what Army Chief of Staff General Rogers has called "the best military force ever fielded by this nation."

The simplest way to bring about the 'failure' of the AVF, of course, is to create sufficient public concern over military manpower costs to substantially force military pay and benefits downward. When volunteers then find military service unattractive, force levels will not be met and the case for a new draft will have been made.

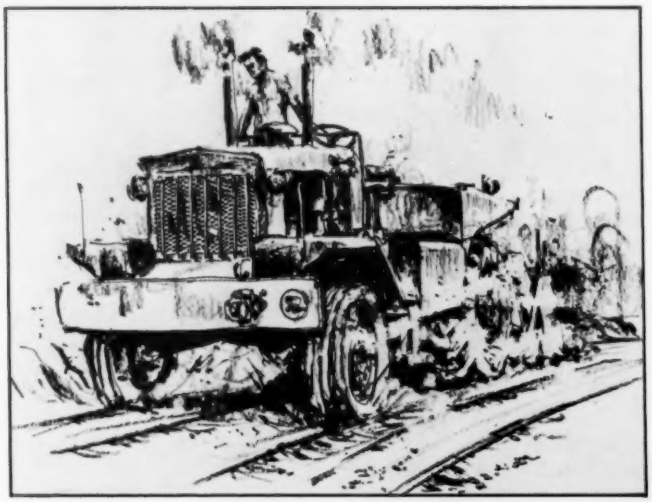
The themes invite accomplices.

But don't fall for it, for if it succeeds, the AVF will not be the only victim. We all will become victimized.

It wouldn't be the first time we were stuck with a 'bargain' in national defense.

The Environment During Construction

Continued from page 33



periodically agitating a layer of the material about .457m (18 in.) thick with a bulldozer to keep a crust from forming on top. Instead, a paper-thin layer of water is always exposed on top, insuring a high rate of evaporation. The remaining dewatered material can be compacted and used for many of the uses suggested above, including use as economical construction fill.

If, in fact, the suggested uses of dredged material can be implemented on a wide scale, the persistent environmental objections to other disposal methods may be avoided.

We have looked at those aspects of environmental concerns in construction which have drawn the preponderance of attention in professional construction journals.

It appears that in all of these areas, interest within the engineering community was generated by the actions of concerned environmentalist groups. Perhaps this suggests that the role and expectation of the engineer should be expanded to increase emphasis on consideration of environmental concerns during construction. The formation of the ASCE Committee on Social and Environmental Concerns in Construction is a healthy step in that direction. Also, the development of an Environmental Impact Report for Federal projects permits the engineer to consider the effects of the construction itself.

It is only by judiciously examining the effects of construction, the degree of impact on the environment, and the economic factors involved in minimizing detrimental effects, that the engineer will successfully fulfill his responsibilities to the public with respect to environmental concerns in construction.

An interesting supplement to this material is the "Environmental Guidebook For Construction" published by the Bureau of Reclamation, Engineering and Research Center, Attn: Code 922, Denver Federal Center, Denver, Colo. 80225. (Price $1.00. Refer to Stock Number 2403-00090)

ACKNOWLEDGMENTS

The author acknowledges with appreciation the permission of the American Society of Civil Engineers and the Society of American Military Engineers to quote or otherwise refer to certain publications issued by the organizations: Civil Engineering ASCE, *June 1971, p. 40; Robert F. Borg,* Journal of Construction Division (ASCE), *March 1976, p. 10; David A. Spivey,* Journal of Construction Division (ASCE), *Sept. 1974, p. 397 — Dec. 1974, p. 501, BGEN W. O. Bachus,* The Military Engineer, *Mar.-Apr. 1975, p. 72.*

Officers Pictured On Back Cover

Front row from left — Ens Gerald Frentz, Ens Thomas Beckman, CWO2 Robert Obey, Ens Robert Spiller, Ens Kumar DeSilva, Lt William Collins, Ltjg Gary Fitzpatrick, Ens Todd Coyle, Ens Paul Davies, Ens Paul McMahon, Jr., Ens Alison Ingram; **Second row** — Ens Jennifer Jones, Ens Eric Smith, Ens Roger Mustain, Ens Roscoe George III, Ens David Kirkman, Ltjg Abdulaziz Al-Namlah, Ens Stephen Holcomb, Ltjg Kenneth Shankle, Ens Steven Phalon, Ens William Hoppe, Ens Daniel Aucremanne; **Third Row** — Ens John Brandt, Ltjg George Titus, Ens Robert Berger, Ens Kenneth Tuebner, Ens Albert Garcia, Ens James Vilbert, Ens Michael Conaway, Ens Thomas Yurik, Ens Olvice Greenwood, Ens Richard Jones; **Back row** — Ens William Elvey, Ens Marcus Kemper, Ens John McClaine, Ens Jerry Alverson, and Ltjg Thomas Martyn.

SPEAKING FROM TOPSIDE

"We cannot dodge or ignore the public nature of what we do..."

Professionalism is a word we hear often in the Naval Facilities Engineering Command. We stress the importance of being an organization of professionals in the facilities business and pride ourselves in our accomplishments. There is great emphasis placed on the various symbols of professionalism and this is as it should be. Advanced degrees, professional registration and participation in professional societies are all visible indications of professionalism. However, I want to consider another facet of this broad subject, one which is becoming more important to us in the successful transaction of our business.

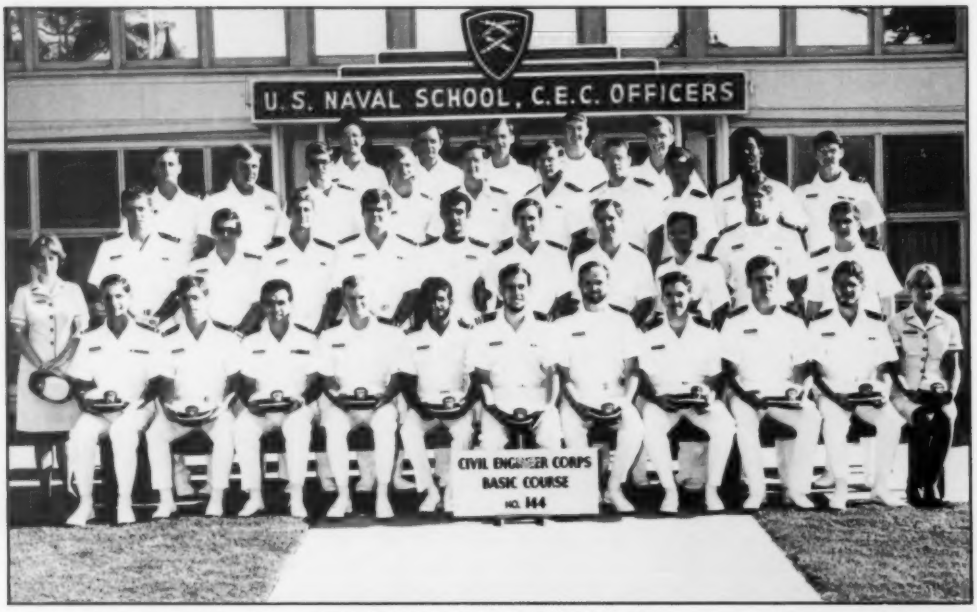
We are now in an era where the Freedom of Information and Privacy Acts often lead us down conflicting paths. At every turn we see our actions questioned for a variety of reasons. For example, turnkey housing construction awards are constantly being protested to the Comptroller General and to the courts. Environmental Impact Statements are being similarly challenged in courts and the results have been some delays on a few of our projects. Contractual requirements and omissions are being highlighted and frequently the results are change orders and claims, all of which add cost to the project and to contract administration. Intergovernmental relations are becoming more important to us in our business dealings with local governmental bodies. There is no aspect of our facilities business today that cannot and does not receive scrutiny from the private sector and other governmental agencies. More than ever before, we must be able to justify our professional efforts when they are subjected to public examination. There is no way that examination of this type can be avoided; however, the presentation of a well documented case will be and has been to our benefit. It is the professionally prepared documentation, such as Environmental Impact Statements and contract documents, by which we justify our case. Therefore, all our professional efforts must be done with the thought in mind that they may be subject to some form of public scrutiny, up to and including the courts. We cannot expect our position to be successfully defended if the justification is not present. This means that a high level of professional performance must be evident throughout the life of a project, particularly at the key points of approval where the action taken impacts outside the Naval Facilities Engineering Command.

Advice and assistance in the areas of procurement protests, public disclosure and intergovernmental cooperation are available in Counsel and your Contracts Division. The increasingly complex and open world in which we do business makes it absolutely essential that these two groups be an integral part of the planning and decision making process. They help us interpret the many laws, rules and regulations which govern our day-to-day business and compliment the engineering side of the effort.

In summary, I again want to emphasize the importance of professionalism at every step of the way in our facilities business. We cannot dodge or ignore the public nature of what we do and can expect to have our decisions questioned by others outside the Command. If we have done the truly professional job that we are expected to do, our case should be sustained when it is questioned. It is a major personal challenge to each of us.

Neal W. Clements

Rear Admiral, CEC, USN
Commander, Pacific Division, NAVFAC
and
Commander, Construction Battalions Pacific



Officer Graduates Are Identified On Bottom Of Page 46

Where did recent graduate engineers of the Navy Civil Engineer Corps GO?

Originations

Calif. State U.
U. of Florida
Florida Tech.
U. of Idaho
Purdue U.
U. of Evansville
U. of Kentucky
Lousiana State
Naval Academy
M. I. T.
U. of Missouri
Cornell U.
Rochester U.
Oregon State
U. of Pittsburgh
Villanova U.
The Citadel
Vanderbilt U.
Prarie View U.
V. M. I.
U. of Virginia
U. of Washington

Construction and maintenance of the Navy's shore and support installations is just one of the responsibilities of the engineer managers of the Navy's Civil Engineer Corps. And qualification is not limited to the civil engineering discipline, as the Corps requires graduate engineers of mechanical, chemical, electrical, industrial and construction disciplines and architecture too! As a commissioned officer of the U.S. Navy the young engineer is offered greater opportunity to develop quickly a professional career with the added potentialities of an exciting overseas assignment, professional registration and graduate studies! The young officer may be assigned to construction contract administration, public works management or with a Naval Mobile Construction Battalion, the historic Seabees, plus many individual and unique positions.

Engineering students and counselors are invited to explore the multifaceted world of the Navy's Civil Engineer Corps by contacting their local Navy Recruiter for specific details. An informal visit with a Civil Engineer Corps officer to discuss the personal and professional benefits of a Navy career can be arranged by the same Navy recruiter or by calling or writing the Naval Facilities Engineering Command, (ATTN Code 09MA1), 200 Stovall Street, Alexandria, Va., 22332 Telephone: (202) 695-3635.

Call toll-free 800-841-8000 now if you desire instant information from the Naval Recruiting Command. If you're a good student, and want to be a better engineer, the chances are you'll do best by investigating the Civil Engineer Corps of the U.S. Navy.

Destinations

Cuba
Puerto Rico
Bermuda
Italy
Spain
Maryland
Japan
Virginia
Hawaii
Great Lakes
Spain
California
Iceland
Nevada
Virginia
Massachusetts
D. C.
Washington
California
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Florida
Guam

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